Faculty of Biological and Environmental Sciences
University of Helsinki

The HELCOM Ecosystem Approach: time for quantification, integration, and measures

2003-2018 implementation of the Ecosystem Approach concept in the regional intergovernmental work of the Baltic Marine Environment Protection Commission (HELCOM)

Hermanni Backer Johnsen

DOCTORAL DISSERTATION
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So there has ever been and ever will be.

Mika Waltari, The Egyptian

But we can make invitations.

We can invite people to walk.

We can invite people to sit, to stay.

That is all we can do.

David Sims, Gehl Architects

in Dahlsgaard, Andreas M. 2012.

The Human Scale. (83 min.)

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LIST OF ORIGINAL PUBLICATIONS

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The contribution of Hermanni Backer Johnsen (HBJ) to the papers above was as follows:

Article I: HBJ had main responsibility for research, concept and writing of the manuscript with support from JML.

Article II: HBJ had main responsibility for research, concept and writing of the manuscript with support from all co-authors.

Articles III, IV & V: HBJ had main responsibility for research, concept and writing of the manuscript

ABSTRACT

This thesis studies the ecosystem approach (EA) which is a concept used in environmental science, policy, and law. It is widely referred to in protection of the world's seas and oceans, including the work of The Baltic Marine Environment Protection Commission (HELCOM). In general, the ecosystem approach reflects the idea that management should be more integrated across different human activities but also that it should be based on, usually scientific, knowledge of ecosystems.

This thesis aims at contributing to the understanding of the ecosystem approach by studying and outlining a HELCOM interpretation as emerging from the implementation process 2003-2018. The thesis is based on the findings of five articles, four of which provide case studies on different aspects of EA implementation at HELCOM based on meeting records, literature research and first-hand knowledge. The fifth article is a study of HELCOM work 2003-2018 based on attendance and topics of 724 international meetings organised during the implementation period, types of organizational output and the outcomes of Ministerial Meetings.

The results of the fifth article indicate that the annual HELCOM work has doubled in volume during 2003-2018, measured as hours spent in meetings. This increase can be attributed to a general dilation, across all activities, as well as new fields of work. Comparing the types of documents adopted by HELCOM in the beginning and end of the period 2003-2018 there is some evidence that a shift has taken place from technical specifications and concrete emission standards to more assessment products & indicators. Based on the data collected it is not possible to conclude whether these developments are a result of EA implementation as such, or primarily due to other factors such as the parallel, and closely intertwined, implementation of the EU Marine Strategy Framework Directive (MSFD).

The summary derives a conceptual framework for EA with three elements, to report and discuss the findings of the five Articles. The thesis concludes that, as implemented within HELCOM, EA can be characterised by an element of *quantification* consisting of definitions and regulatory use of scientific targets of ecosystem quality, with roots in EU regulatory approaches and a different focus compared to the EA as defined within the Convention on Biological Diversity (CBD), as well as by an element of *integration* manifested in a significant expansion of HELCOM activities in the fields of MSP, Fisheries, Agriculture and regional linkages to EU and global policies. However, regarding the third element, EA resulting in concrete management *measures*, has been a central component of implementation activities but the main result seems to be in providing a more elaborate ways for proposing, justifying,

specifying, and reporting the achievement of management action decided in other processes than HELCOM, with some exceptions.

Due to its scientific nature the EA element of quantification is more an evolution of the traditional HELCOM monitoring and assessment work, however the integration element involves expansion of cooperation to new substance areas, professional groups, and worldviews. This work requires diplomatic effort and innovation for joint solutions to the environmental problems of the Baltic Sea. More focus on relevant human activities, drivers of change and monitoring progress in the implementation on key management measures affecting the state of the marine environment, but also scenarios and foresight could provide new avenues for the protection of the Baltic Sea.

Keywords: sea, marine, ecosystem management, regional seas cooperation, Helsinki Convention, Baltic Sea, EU, Marine Strategy Framework Directive, marine spatial planning, MSP, international organization, meeting

TIIVISTELMÄ

Tämä väitöskirja käsittelee ekosysteemilähestymistapaa (eng. the ecosystem approach) joka on ympäristötieteiden, -suojelun ja -sääntelyn alaan kuuluva käsite. Ekosysteemilähestymistapaan viitataan laajalti mertensuojelussa, kuten myös Itämeren Suojelukomission (HELCOM) työssä. Yleisellä tasolla käsite pohjaa ajatukseen, jonka mukaan ympäristöä koskevan viranomaistyön sekä sääntelyn tulisi olla yhdennettyä eri hallintoalojen kesken, mutta myös että niiden tulisi pohjautua parhaaseen saatavilla olevaan, yleensä tieteelliseen, tietoon ekosysteemeistä. Tämä väitöskirjan tavoitteena on selventää käsitteen sisältöä tutkimalla HELCOMin työtä sen toimeenpanemiseksi 2003–2018 sekä tarjota tuloksista johdettavia huomioita tutkimuksen, muiden aloitteiden sekä organisaation oman jatkotyön avuksi.

Väitöskirja perustuu viiden artikkelin tuloksiin, joista neljä on kokousasiakirjoihin, kirjallisuuteen ja ensikäden tietoon perustuvia tapaustutkimuksia HELCOMin ekosysteemilähestymistapaa koskevan työn eri osa-alueista. Viides artikkeli tutkii kokonaisvaltaisemmin HELCOM työtä 2003–2018 perustuen ajanjaksolla järjestettyjen 724 kansainvälisen kokousten osallistujatietoihin ja aiheisiin, hyväksyttyjen asiakirjojen luokitukseen (toimenpiteet ja selvitykset) sekä viiden ministeritason kokouksen kirjauksiin.

Kansainvälisissä kokouksissa vietettyinä henkilötunteina mitattu HELCOM työ on kaksinkertaistunut ajanjaksolla 2003–2018. Kokoustuntien kasvu voidaan kohdentaa yleiseen, kaikilla osa-alueilla tapahtuneeseen, kasvuun sekä uusia aihealueita (merialuesuunnittelu, kalastus ja maanviljely) koskevaan työhön. Ajanjaksolla hyväksyttyjen asiakirjojen lukumääriä ja tyyppejä tarkasteltaessa teknisten määräysten ja päästöstandardien suhteellinen merkitys on laskenut ja arviointiraporttien sekä indikaattorien vastaavasti kasvanut. Aineiston perusteella ei voi päätellä johtuvatko nämä muutokset ekosysteemilähestymistavasta vai muista tekijöistä, kuten siihen läheisesti liittyvästä EU Meristrategiadirektiivin toimeenpanotyöstä.

Johdanto esittää ekosysteemilähestymistapaa jäsentävän, kolme pääteema sisältävän, käsitteellisen viitekehyksen ja käyttää sitä viiden artikkelin tulosten esittämiseen ja pohdintaan. Loppupäätelmissä HELCOMin tulkinta käsitteestä nähdään osaltaan *määrällistämisenä*, luonnontieteellisiin meriympäristön hyvän tilan määritelmiin liittyvänä työnä, joka pohjautuu Euroopan Unionin (EU) ympäristösääntelyyn ja tuo käsitteeseen eri painotuksen verrattuna YK biodiversiteettisopimuksen määritelmään, mutta myös *yhdentämisenä,* eri hallinnonaloja lähentävänä toimintana*,* joka on havaittavissa merialuesuunnittelua, kalastusta ja maanviljelyä koskevan työn merkittävänä lisääntymisenä sekä globaalin ja EU-työn alueellisina ulottuvuuksina. Kolmas teema, ekosysteemilähestymistapa ympäristöä

koskevina konkreettisina *toimenpiteinä*, on ollut keskeinen käsitteen toimeenpanossa mutta vaikuttaa lähinnä tarjoavan kehittyneempiä työkaluja ehdottaa, perustella, tunnistaa ja raportoida toimenpiteitä, jotka päätetään lopulta toisaalla.

Jos Itämeren määrällistämiseen liittyvä työ voidaan nähdä HELCOMin perinteisen, tieteellisen, seuranta- ja arviointityön uutena kehitysvaiheena, on yhdentämiseen liittyvä laajeneminen tuonut mertensuojelutyön lähempään vuorovaikutukseen uusien ammattiryhmien, tavoitteiden ja arvomaailmoiden kanssa. Tällainen yhteistyö vaatii diplomaattisia ponnisteluja sekä innovaatioita, jotta mahdollistetaan ratkaisuja Itämeren suojeluun keskinäisen oppimisen ja keskustelun kautta. Meren tilaan vaikuttavien ihmistoimintojen, muutostekijöiden sekä keskeisten konkreettisten toimenpiteiden lähempi seuraaminen ja arvioiminen, mutta myös skenaariot ja muu tulevaisuustyö voisivat tuoda uusia avauksia Itämeren suojelutyöhön.

Avainsanat: meri, ekosysteemilähestymistapa, alueellinen yhteistyö, mertensuojelu, Itämeri, Itämeren Suojelukomissio, EU, meristrategiadirektiivi, merialuesuunnittelu, kansainvälinen järjestö, kokous

SAMMANDRAG

Denna avhandling studerar ekosystemansatsen (EA, Eng. the ecosystem approach) som är ett begrepp inom miljövetenskap, -förvaltning och -lagstiftning. Man refererar ofta till ekosystemansatsen inom initiativ för att skydda och återställa världens havsområden, inklusive Östersjökommissionens (HELCOM) arbete för Östersjöns marina miljö. Begreppet återspeglar i allmänhet tanken att miljöförvaltning och lagstiftning skall vara mer integrerad, eller ha ett helhetsgrepp, över olika förvaltningsgrenar men också att den ska baseras på, vanligtvis vetenskaplig, kunskap om ekosystemen. Denna avhandling bidrar till förståelsen av ekosystemansatsen genom att studera HELCOMs genomförande av begreppet 2003-2018, samt erbjuder iakttagelser för forskning, vidare utvecklingsarbete inom HELCOM och andra initiativ.

Avhandlingen baserar sig på resultaten av fem artiklar, varav fyra är fallstudier kring olika sidor av genomförandet av EA inom HELCOM och baserade på mötesrapporter, litteraturforskning och förstahandsuppgifter. Den femte artikeln är en studie av HELCOM-arbetet 2003–2018 baserat på information om deltagande och innehåll av de 724 internationella HELCOM -möten som anordnades under genomförandeperioden, en klassificering av antagna dokument samt deklarationer från möten på ministernivå.

Resultaten av den femte artikeln indikerar att det årliga HELCOM-arbetet har volymmässigt fördubblats under perioden 2003–2018, mätt i antalet personstimmar som spenderats i internationella möten. Ökningen kan tillskrivas en genomgående utvidgning såväl som de nya arbetsområdena (havsplanering, fiskeri och jordbruk), medan det vetenskapliga bedömningsarbetet har behållit den relativa andelen trots det nya fokuset. Jämförelse av de dokumenttyper som antagits av HELCOM i början och slutet av perioden 2003–2018 visar på att en övergång har ägt rum från tekniska specifikationer och konkreta utsläppsstandarder till mer bedömningar och indikatorer. Det är inte möjligt att dra slutsatser om denna utveckling är ett resultat av EA-genomförandet i sig eller främst på grund av andra faktorer, såsom det parallella arbetet kring EU:s havsmiljödirektiv, på basis av materialet.

Avhandlingen härleder en konceptuell ram för EA med tre element, som sedan används för att sammanfatta och diskutera resultaten i de fem artiklarna. EA såsom den genomförts inom HELCOM kan beskrivas dels genom ett element av *kvantifiering,* bestående av arbete kring vetenskapliga mål för ekosystemkvalitet, med rötter i EU: s reglering och ett annat fokus än den globalt dominerande definitionen av EA enligt Konventionen om biologisk mångfald (CBD), samt genom ett element av *integration* som innebär en betydande utvidgning av HELCOM-aktiviteter inom MSP, fiske, jordbruk och regionala kopplingar till EU och dels global reglering. Det tredje elementet, EA

som konkreta *åtgärder,* har varit en central del av genomföringen men har främst resulterat i mer detaljerade sätt att föreslå, motivera, specificera och rapportera åtgärder som bestämts i andra processer än HELCOM.

På grund av dess vetenskapliga karaktär är arbetet kring kvalitetsmål mer en utveckling av det traditionella HELCOM-övervaknings- och bedömningsarbetet. Däremot innebär integrationselementet en utvidgning av samarbetet till nya ämnesområden, yrkesgrupper och världsbilder. Detta kräver diplomatiska insatser och innovation för att möjliggöra gemensamma lösningar på Östersjöns miljöproblem. Mer fokus på mänskliga verksamheter, underliggande drivkrafter och närmare uppföljning av framsteg i kritiska åtgärder, men också scenarie-och framtidsarbete kunde peka på nya vägar för skyddet av Östersjön.

Nyckelord: Hav, miljö, ekosystemansats, regionalt arbete, miljökonvention, Östersjökommissionen, Östersjön, EU, havsmiljödirektiv, havsplanerings, internationell organisation, möte.

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Even if this thesis has in many ways been an adventure it has also been a “never ending song of love”. It started as an idea somewhere back in 2008 and the train has slowly and erratically yanked forward in-between busy jobs, other tasks, and events of life. It feels somewhat unreal that it is really coming to an end station soon (hope the brakes work!).

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ABBREVIATIONS

BALTFISH: The Baltic Sea Fisheries Forum, a regional fisheries body in the Baltic Sea initiated in 2009 based on the regionalisation of the EU CFP.

BAT: The Best Available Technology or Best Available Techniques

BEP: The Best Environmental Practice

BONUS: A research programme 2010-2017 on the Baltic Sea marine environment established under Article 185 of the Treaty on the Functioning of the European Union. Followed by

BSAP: The HELCOM Baltic Sea Action Plan (BSAP), adopted by the HELCOM Contracting Parties at the Ministerial Meeting, Krakow, Poland, 15 November 2007.

CAP: The Common Agricultural Policy, the agricultural policy of the EU.

CART: Country Allocated Reduction Targets, nutrient pollution reduction targets needed to reach MAI levels, originally adopted with the HELCOM BSAP and revised in 2013.

CBD: The Convention on Biological Diversity, (informally as the Biodiversity Convention), Rio de Janeiro on 5 June 1992.

CFP: The Common Fisheries Policy, the fisheries policy of the EU.

CLRTAP: The Convention on Long-Range Transboundary Air Pollution (also abbreviated as Air Convention), November 13, 1979.

DAPSI(W)R(M): Drivers-Activities- Pressures-State- Impacts (on human Welfare)- Responses (as Measures), a further elaboration of the classical Drivers-Pressures-State-Impact-Responses (DPSIR) framework. (Elliott et al., 2017)

DPSIR: The Drivers-Pressures-State-Impact-Responses (DPSIR) framework (Rapport and Friend, 1979)

EA: The Ecosystem Approach

EBA: The Ecosystem-Based approach

EBM: The Ecosystem-Based management

EMEP: European Monitoring and Evaluation Programme

EU: The European Union

EUSBSR: The European Union Strategy for the Baltic Sea Region (EUSBSR) is the first Macro-regional Strategy in Europe, approved by the European Council in 2009

FAO: The Food and Agriculture Organization of the United Nations

GEAR: The HELCOM Group on the Implementation of the Ecosystem Approach, a group tasked with the practical work to coordinate EU MSFD implementation in the Baltic Sea.

GEF: The Global Environment Facility (fund)

HELCOM: The Baltic Marine Environment Protection Commission (Helsinki Commission - HELCOM) is an intergovernmental organization the governing body of the 1974/1992 Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention)

HOD: (or HELCOM HOD) The Heads of Delegation of HELCOM. This is a decision-making body, originally established as an intersessional extension of the once-per-year Helsinki Commission (HELCOM) meetings.

ICES: The International Council for the Exploration of the Sea

IMO: The International Maritime Organization, a specialised agency of the UN responsible for regulating shipping.

INTERREG: A series of EU funding programmes aiming to stimulate cooperation between regions in, and beyond, the EU. Funded by the European Regional Development Fund (ERDF).

LME: Large Marine Ecosystem, a concept developed by NOAA to divide worlds and oceans to distinct regions.

MAI: Maximum Allowable Inputs (MAI), a level of nutrient pollution enabling good status of the Baltic Sea marine environment, originally adopted with the HELCOM BSAP in 2007 and revised in 2013.

MARPOL: (or MARPOL 73/78) The International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978.

MoU: Memorandum of Understanding, especially MoU on Port State Control (PSC), an international inspection regime for foreign flagged vessels.

MSFD: The Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive).

MSP: Marine or Maritime Spatial Planning, a form of spatial planning at sea.

MSPD: The Directive 2014/89/EU of the European Parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning

NECA: NOx Emission Control Area, a commonly used term for MARPOL Annex VI ECA with regard to NOx emissions.

NOAA: National Oceanic and Atmospheric Administration, a national agency of the United States of America (USA).

OSPAR Commission: The governing body of the Convention for the Protection of the Marine Environment of the North-East Atlantic or OSPAR Convention.

RFMO: Regional Fisheries Management Organisation. RFMOs are international organisations formed by countries with fishing

interests in a sea area. RFMOs have global cooperation via the FAO Committee on Fisheries (COFI), a subsidiary body of the FAO Council.

SDGs: The Sustainable Development Goals (SDGs) a set of 17 goals agreed by the UN General Assembly in 2015 as part of UN Resolution on the 2030 Agenda. Includes e.g. SDG 14 "Life below water".

UK: The United Kingdom

UN: The United Nations

UNCED: The United Nations Conference on Environment and Development (UNCED), Earth Summit. Rio de Janeiro, Brazil 3-14 June 1992

UNCLOS: The United Nations Convention on the Law of the Sea of 10 December 1982

UNECE: United Nations Economic Commission for Europe.

UNEP MAP: (or UNEP/MAP) The Mediterranean Action Plan of the United Nations Environment Programme is a regional cooperation platform established in 1975 as the first regional action plan under the UNEP Regional Seas Programme.

UNEP: (also UN-Environment) The United Nations Environment Programme

UNGA: The General Assembly of the United Nations

VASAB: Visions and Strategies Around the Baltic Sea, a regional intergovernmental cooperation organization in the Baltic Sea region focusing on spatial planning and territorial development.

WFD: Water Framework Directive. The Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy.

WSSD: The World Summit on Sustainable Development 2002, Johannesburg, South Africa, 26 August - 4 September 2002

1 INTRODUCTION

This thesis studies a concept used in environmental management, science and law called the *ecosystem approach to the management of human activities,* or in short, the *ecosystem approach (EA)* (CBD, 2000, 1998, 1995).[1] Even if many specific interpretations of its meaning exists, in general the concept reflect views that environmental management and law should be less fragmented, and more integrated, across different fields of human activity. The background for such calls is the legacy for the opposite, in marine and ocean context the parallel management structures for issues such as environmental protection, fisheries and shipping. The ecosystem approach also highlights the importance of using the best available, usually scientific, knowledge on the *ecosystems* under regulation. Ecosystems in turn refer to living and non-living components interacting as a functional unit (Begon et al., 2006, p. 499; CBD, 1992; Hanski et al., 1998, p. 32; O'Neill, 2001), in a wider sense including also human societies (ESF et al., 2010, p.17). Since the 1990s the ecosystem approach concept has been frequently referred to in the field of international environmental cooperation including that on the world's marine and freshwater ecosystems (Rice et al., 2005; Sherman and Duda, 1999; UNEP, 2013). This includes the specific context of this study: the Baltic Sea and the work of the Helsinki Commission (HELCOM)[2], a regional intergovernmental organization working for protection of the marine environment of the Baltic Sea, based on the Helsinki Convention (HELCOM, 1992).

As documented and discussed in the field of international law, the ecosystem approach can be considered to belong to a group of essentially complex concepts, offering multiple and sometimes contradictory interpretations, which are typical in international environmental cooperation[3] (Beyerlin, 2007; Boyle, 2006). This indeterminacy refers both to substance, what the concept is about, and normative quality, what its qualities are as law (Beyerlin, 2007). Importantly, the resulting vagueness is often not due to a lack of analytical capacity but manifests a compromise reached in negotiations between states and competing interests. Klabbers (2013) refers to this feature as "constructive ambiguity", which is illustrative of its function as a conceptual

[1] This thesis uses the term Ecosystem Approach to cover a group of closely related terms which may have some differences for individual authors or particular fields of study, but are in general used interchangeably (e.g. Ecosystem Approach, Ecosystem Management and Ecosystem Based Management), see Chapter 2 below.

[2] Officially *the Baltic Marine Environment Protection Commission*

[3] Other examples of such concepts include "sustainable development", "precautionary action", "sustainable use", "integrated management".

bridge between conflicting interests, common in environmental issues (Houck, 2003; Ludwig et al., 1993).

Using the classical division of norms by Dworkin (Beyerlin, 2007) to legal rules and principles (latter guiding to the interpretation of rules) as well as the category of non-legal policies, an increasing number of observers (De Lucia, 2019; Langlet and Rayfuse, 2019; Platjouw, 2016) seem to suggest that the ecosystem approach has evolved from a scientific and policy concept also to an emerging legal concept, placed somewhere between law and policy. Legal scholars categorize this kind of concept as "work in progress" (*lex ferenda* in legalese)[4], "soft law" (Boyle, 2006) or more poetically as "twilight norms" (Beyerlin, 2007).

The necessary substantial concreteness of indeterminate concepts such as the ecosystem approach can be assumed to emerge over time, in processes such as the regular cooperation to implement an international agreement (Brunnée, 2002). In fact, even if a definitive universal meaning of the substance of ecosystem approach is difficult or even impossible to identify (De Lucia, 2019), more concrete definitions are to unavoidable in a specific context. A practical translation into concrete activities is needed in order fulfil international commitments to implement it (EU, 2008; JMM, 2003a; UN, 2007, 2006; WSSD, 2002), which in turn defines the concept in implicit terms.

A rapidly growing literature has analysed and synthesized the legal/policy and the scientific dimensions of the ecosystem approach (Borja et al., 2016a; De Lucia, 2019; Kidd et al., 2011; Langlet and Rayfuse, 2018a; Long et al., 2015; McLeod and Leslie, 2009; O'Higgins et al., 2020; Platjouw, 2016). Also, a substantial literature on implementation of the ecosystem approach in the Baltic Sea context is currently available, covering both scientific aspects such as modelling and assessments (Andersen et al., 2015, 2011; Jansson, 1972; Korpinen et al., 2012; Möllmann et al., 2013), as well as the organizational and legal dimensions (Bohman, 2018, 2017; Hassler et al., 2013; Hegland et al., 2015; Langlet and Rayfuse, 2018a; Linke et al., 2014; Ringbom and Joas, 2018; Söderström, 2017; Söderström and Kern, 2017; Valman, 2014), which are in the focus of this thesis.

Even if a substantial literature is available on the ecosystem approach, both within and beyond the Baltic Sea, there remains a need for research on implementation efforts (Langlet and Rayfuse, 2018b; Sander, 2018). Such implementation studies are valuable to other initiatives with similar aims by providing examples of completed, or mature, implementation processes, including possible lessons learned (Langlet and Rayfuse, 2018a, p.447-48). In addition, such studies are needed for the further development of the initiatives under study. Adaptiveness and a cyclic policy process involving continuous learning is a key characteristic feature of the ecosystem approach (Long et al., 2015; Soininen and Platjouw, 2018).

[4]The term *lex ferenda* (future law) is used to separate from *lex lata (*existing law).

The Baltic Sea coastal states and the EU adopted the ecosystem approach concept within HELCOM in 2003 together with a dedicated statement document on the ecosystem approach (JMM, 2003a), as well as a joint commitment to implement it by 2010 (JMM, 2003b). This was regional follow-up of international commitments (CBD, 2000, 1998; WSSD, 2002) as well as European (EC, 2002; EU, 2008) developments. In 2003, shortly after the joint ministerial meeting, HELCOM initiated a suite of activities to reshape its work according to the concept. This implementation work, involving cooperation in new thematic fields as well as scientific work to model and assess the Baltic Sea ecosystem, can be considered to reflect a local HELCOM definition of the substance of the ecosystem approach concept which is examined in this thesis.

While most the Baltic-sea specific literature cited above considers HELCOM as one of the many governance structures in the region, Valman (2014) made a targeted contribution to close the research gap when it comes to ecosystem approach implementation in the HELCOM context. Her PhD thesis studies overall institutional change within HELCOM, focussing also on the emergence and consequences of the ecosystem approach. As material Valman (2014) used the results of computer assisted content analysis of official documents, environmental monitoring data, and interviews. However, as Valman (2014) was focussing on institutional change within HELCOM in general, and not on the ecosystem approach as such, she did not attempt to outline the specific characteristics of the ecosystem approach as emerging from the HELCOM implementation efforts and policy documents. Further, while Valman (2014) studied the texts of meeting records and other official documents 1980-2013 using computer assisted content analysis, she did not study possible changes in the numbers, topics, or attendance of HELCOM meetings during the ecosystem approach implementation process. This thesis will examine such mentioned materials closer to further clarify the specific features of HELCOM implementation of the ecosystem approach concept.

The ultimate aims of this thesis are to contribute to the understanding of the ecosystem approach as a marine management concept by outlining a HELCOM interpretation as emerging from the implementation process 2003-2018, as well as to provide lessons learned to other research and management initiatives worldwide.

These aims will be reached through the following overall objectives:

- identifying the specific features of the ecosystem approach concept as documented and implemented within HELCOM during 2003-2018 by proposing and using a conceptual framework for the ecosystem approach consisting of the three themes of quantification, integration, and measures.
- studying whether HELCOM work has changed during the 2003-2018, if so how, and whether the observed changes can be attributed to the implementation of the ecosystem approach.

This summary article will conclude on findings after synthesising the results of four published articles (Articles I-IV) and one article manuscript (Article V). The four published articles (I-IV) provide in-depth case studies on different aspects of the ecosystem approach implementation based on first-hand experiences, meeting interactions as well as archive and literature research. These papers were written during the period 2004-2018 when the candidate was employed by the HELCOM Secretariat to carry out the reported tasks and draft the documents analysed.

The fifth article (V), a manuscript, is a concluding metadata study on HELCOM meeting attendance and organizational output 2003-2018, providing a more general view and context for the four case-studies, has three specific objectives:

- The first objective of Article V is to examine possible ecosystem approach -induced changes in the day-to-day work of the organization, or whether the absolute or relative number of meeting person hours allocated to specific topics changed during the implementation process. This is done by quantifying the number of person hours (participants x meeting length) spent in the 724 recorded HELCOM meetings 2003-2018, by topic. This unusual, and potentially novel, way to use meeting records of international organizations in research emerged as the only practical way to generate a sufficiently homogenous time series of the work done within HELCOM.
- The second objective of Article V is to study absolute and relative changes in the numbers of two constructed categories of organizational output: "assessments" and "measures" during the implementation period.
- The third objective is to study the evolution of the formal use of the ecosystem approach concept based on mentions in the outcomes of HELCOM Ministerial Meetings 2003, 2007, 2010, 2013 & 2018.

After an overview of the research context of the ecosystem approach and HELCOM as well as deriving a conceptual framework of the concept (Chapter 2), a recap of Aims & Objectives (Chapter 3) and Materials & Methods (Chapter 4) this thesis summary article will present the contents of the constituting articles (Chapter 5), discuss the findings (Chapter 6) conclude by summarising the findings in relation to the aims of the study (Chapter 7), and finally, provide some reflections on the research process and directions for future work (Chapter 8).

2 RESEARCH CONTEXT

For orientation purposes, this chapter will provide the reader with a concise overview of the ecosystem approach concept, as well as a review of literature on its application in the Baltic Sea region and HELCOM. It is based on what is assumed to be a representative selection of the available literature. This material is grouped into three parts: a general introduction to the ecosystem approach concept (2.1), the ecosystem approach in the work of the regional seas organisations in general (2.2) and the ecosystem approach in the HELCOM context (2.3).

Please note that in this thesis summary article the term *ecosystem approach* is used to refer to a concept which is behind an entire group of closely related terms referring to ecosystems and, explicitly or implicitly, to management. These include primarily the *ecosystem approach (EA)* (CBD, 2000, 1998; GLRAB, 1978)[5] but also *ecosystem-based approach (EBA)* (EU, 2014, 2008), *ecosystem-based management (EBM)* (Arkema et al., 2006; McLeod and Leslie, 2009; Slocombe, 1998) and *ecosystem management* (Grumbine, 1994; Yaffee, 1999). The more specific variants, such as *ecosystem-based marine management* (Hegland et al., 2015), *ecosystem-based sea use management* (Douvere, 2008), *ecosystem approach to fisheries management (EAFM)* (Garcia et al., 2003; Wilson, 2009) or *ecosystem-based management of marine resources* (Browman et al., 2005), are also included under the general definition. Other terms, such as the concept of *ecosystem services framework* (Turner and Daily, 2008), can be considered as related, but distinct enough not to fall under the same term.

The reason for this grouping is that even if some of the differences may be significant in some specific legal contexts (e.g. CBD, 1992; EU, 2008), the currently vast scholarly literature on the terms listed above have found different and sometimes contradictory uses for the same terms (De Lucia, 2019; Long et al., 2015). The terminology has also been observed (Langlet and Rayfuse, 2018a, p. 446; Söderström, 2017) to be somewhat unstable because the different terms are sometimes used partly interchangeably and partly not. While Kirkfeldt (2019) found differences between EA, EBM and EBA, these seem to be at least partly linked to variations in legislative and policy terminology (e.g. EU vs USA/Canada), and not necessarily in the underlying substance. Kirkfeldt highlights specifically that there are geographic preferences for the terms; scholars based in North America prefer EBM over EA and EBA, while the opposite is true for European researchers (Kirkfeldt, 2019). These concepts have also experienced a temporal shift where the early focus on natural sciences and objectives on ecological status (especially earlier

[5] The term Ecosystem Approach is also increasingly used in contexts not related to environmental management (e.g. *entrepreneurial ecosystem approach*) which are not considered in this study.

conceptions of *ecosystem management*) has over time been complemented with other types of information, adaptive management and stakeholder participation (Long et al., 2015).

Concludingly, in substantial terms and as used today, EA, EBA, EBM and their variants are in practical terms commonly considered as synonyms in scholarly research on ecosystem approach (De Lucia, 2019; Söderström, 2017, p. 4; Wang, 2004), and also in this study the term *ecosystem approach (EA)* is used in this thesis, even when referring to the content of publications using other specific terms originally. In essence, in the rest of this Chapter, and this thesis at large, the variability in content is explored using an alternative route, by outlining the substantial themes behind such labels.

2.1 CONCEPTUAL ORIGINS

The rest of this chapter will attempt at an outline of the ecosystem approach relying mainly on scholarly literature on international policy and law. The aim is not to give a thorough analysis of original international legal sources on the topic, partly as this is considered beyond the resources for and needs of this summary but also as this has been done by others (e.g. De Lucia, 2019; Platjouw, 2016). After a general introduction, the text will reflect on the substantial meaning of the concept propose a conceptual framework based on the findings, as well as consider what its legal implications could be.

The ecosystem approach has its origins in attempts to translate ecological science, and scientific rationality, to the world of international policy and law. From the early years (e.g. Read, 1963), scientific information has been a key factor in environmental law and management, in identifying both the scope of the challenges and potential solutions (Andresen and Skjaerseth, 2007). This link between science and management has given experts from the field of ecology and related fields of science an important role in environmental policy and law (Bocking, 1997; Haas, 1990).

In the world of science, the ecosystem approach evidently has its roots in the concept of *ecosystem* (Begon et al., 2006; Hanski et al., 1998).[6] According to the classical definition, an ecosystem refers to assemblages of living organisms, but also the physical factors they are surrounded by, considered together as a *system* (Tansley, 1935, pp. 299–303; Von Bertalanffy, 1950) which also includes the interactions between the constituent parts. A key source of the content behind *ecosystem* and thus *ecosystem approach* is naturally also the study and science of *ecology* (e.g. Haeckel, 1866, p. 286), or

[6] From Ancient greek oikos (*οἶκος*), referring to three related but distinct concepts: the family, the family's property, and the house, and systema *(σύστημα)*, the latter of which can be considered as having two roots – syn ("with"), and histanai ("stand together").

the relationships between the organism and its physical environment, a topic which was studied already during antiquity (Hughes, 1988).[7]

The systems perspective, inherent in the ecosystem concept, was from the beginning borrowed from the physical sciences (Tansley, 1935, p. 299), and linked to a machine analogy (O'Neill, 2001). With the increasing knowledge of the adaptive and emergent properties of ecosystems, the analogy has been questioned, and has consequently evolved and refined (O'Neill, 2001). Combined with data from environmental monitoring programmes (Rich, 1980) and earlier work with models (Edwards, 2011), the systems perspective has evolved to provide the basis for modelling and assessing the interactions between the living and non-living, including also human societies and pollution (Jansson, 1972; Leontief, 1970; Meadows et al., 1982; Odum, 1971; Sellar et al., 2019; Wulff, 2007). In addition to confined areas and applications (Jansson, 1972; Wulff, 2007) such efforts have been applied to planetary scale studies (Meadows et al., 1982; e.g. Park et al., 2019) also as what is called earth system science (Reichstein et al., 2019; Reid et al., 2010; Sellar et al., 2019).

Ecosystem science and the modelling of ecosystems, including human societies, provided a foundation for new forms of environmental management and law. This included calls for more integrated management which would take into account the complex interactions involved in environmental protection.[8] Early examples include the holistic agenda of the 1972 UN Stockholm conference (UN, 1973) as well as academic proposals such as the *ecomanagement* concept proposed by Mayda in 1968 (Mayda, 1973). Over time the scientific concept of the *ecosystem* has been established in environmental law and management (Bocking, 1997; Scheiber, 1997), providing the foundation of several international environmental agreements (Tarlock, 2012).

2.2 THE ECOSYSTEM APPROACH

The ecosystem approach is a popular concept in international cooperation on the marine and freshwater environments (Long, 2012). After 1980s, when it matured within pioneering regional initiatives in fields such as the management of marine (CCAMLR, 1980; de Jong, 1992) and freshwater (GLRAB, 1978; Lee et al., 1982; UNECE, 1992) ecosystems, it was introduced to global environmental negotiations after the 1992 World Summit on Sustainable Development (UNCED, 1992) and subsequent work by CBD (2004) and UN Food and Agricultural Organization (FAO, e.g. the 1995 Code of Conduct). From these beginnings it was included in the general

[7] e.g. One example is the work of Theophrastus, a disciple and successor of Aristotle, and his concepts of *oikeios topos* and *oikeia chora*, precursors to the concept of niche (Hughes, 1988).

[8] Ecosystem models enable also the definition and use of quantitative targets for parameters of ecosystem state and pressures affecting it.

international environmental cooperation by dedicated paragraphs 30d & 30e[9] in the 2002 Johannesburg Plan of Implementation (WSSD, 2002) and eventually in the resolutions of the General Assembly of the United Nations (UN, 2007, 2006).

The substance of the *ecosystem approach* concept can be explored using the results of the literature review by Waylen et al (2014), which separates between two main constituent themes. The first is the ecosystem approach according to CBD, primarily a form of integrated and socially engaged environmental governance, and the other is the ecosystem approach as science-based management (Waylen et al., 2014), related to the enhanced use of science in the form of eco-standards, scientific assessments, multi-species frameworks and ecosystem models. These two themes are also discernible in the history of international ocean policy and law, where different negotiation strands, e.g. those for the 1982 United Nations Convention on the Law of the Sea (UNCLOS), the 1992 United Nations Conference on Environment and Development (UNCED),[10] as well as within the Food and Agriculture Organization of the United Nations (FAO), have emphasized dimensions of the ecosystem approach as relevant for their mandate (Turrell, 2004).

Waylen et al (2014) also highlight a third group of main meaning given in literature, the ecosystem approach as referring to the use of the *ecosystem services* concept (Waylen et al., 2014), a way to include the value of ecosystems to economic models and related decisions, popularized by the Millennium Ecosystem Assessment (MEA, 2005). However, the authors also conclude that while they see the ecosystem services as valuable in developing ecosystem assessment activities as part of EA, it does not constitute a full alternative conception of EA (Waylen et al., 2014). Likewise, in this thesis the theme of ecosystem services is seen as a part of the second conception of the ecosystem approach focused on science-based assessments.

[9] Paragraph 30 (d) "*Encourage the application by 2010 of the ecosystem approach*"; and Paragraph 30 (e) "*Promote integrated, multidisciplinary and multisectoral coastal and ocean management at the national level and encourage and assist coastal States in developing ocean policies and mechanisms on integrated coastal management*".

[10] Earth Summit. Rio de Janeiro, Brazil 3-14 June 1992.

EA as "integration"

The Convention of Biological Diversity (CBD) definition, and guidance to the use of the ecosystem approach remain the most widely influential formal source for the legal or policy meaning of the concept. In the CBD context the concept is broadly defined as "…a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way" (§A5 of CBD, 2000, 1995). The 12 Malawi principles (CBD, 2000, 1998) as well as five points of operational guidance (CBD, 2000) provide further details to support practical implementation efforts. The operational guidance presented in Table 1 are illustrative of the focus of the CBD definition of the ecosystem approach which, as pointed out by De Lucia (2019, p. 185), can be referred to as *integration*.

Table 1. *The five points of operational guidance for the application of the ecosystem approach within CBD (CBD, 2004, 2000).*

CBD operational guidance for application of the ecosystem approach
1. Focus on the relationships and processes within an ecosystem.
2. Enhance benefit-sharing.
3. Use adaptive management practices.
4. Carry out management actions at the scale appropriate for the issue being addressed, with decentralization to lowest level, as appropriate.
5. Ensure intersectoral cooperation.

In the field of marine management, the integrative conceptions underlying the CBD definition of the ecosystem approach are related to a long lineage of calls for more integrated management of oceans and seas (Underdal, 1980). [11] This is perceived to provide better tools to address the advancing degradation of the marine environment than the, sometimes conflicting, work of the traditional single-issue management agencies, research institutions and even international agreements. The same aims and ideals of coherence and integration are underlying the field of Marine Spatial Planning (MSP) (Ehler, 2009; Jay, 2010), a process where access to marine space is divided among different activities.

More generally, this notion can perhaps be considered to focus on efforts to generate joint direction for environmental management through increasing dialogue between different interests, whether policies, groups of citizens, organizations, or other entities.

[11] Early examples include e.g. the 1967 speech of Arvid Pardo at the United Nations General Assembly (UNGA) (Pardo, 1967), outlining the deep sea bed as common heritage of mankind, the 1970 call for integrated management in the preambular of a related UNGA resolution ("*Conscious that the problems of ocean space areclosely interrelated and need to be considered as a whole"*) (UNGA, 1970), the 1972 Stockholm Conference outcome (UN, 1973) and the wide remit of the 1982 United Nations Convention on the Law of the Seas (UNCLOS) (UN, 1982).

EA as "science"

The other main theme, reflecting the ecosystem approach as a form of rational science-based management, is more difficult to summarise in a concise way as it does not have a single institutional source comparable to the CBD. It is related to early work in North America (GLRAB, 1978), context of the North Sea cooperation (anon., 2002; de Jong, 1992; Heslenfeld and Enserink, 2008; Misund and Skjoldal, 2005), ecosystem science -based fisheries advice and management efforts e.g. within FAO (Garcia et al., 2003), as well as to the science-based approach of the Large Marine Ecosystem (LME), initiatives funded since the 1990s by the Global Environment Facility (GEF) (Sherman, 1995; Wang, 2004).

This second conception of the ecosystem approach can be illustrated with the stepwise approach of the ICES report from 2005 (Rice et al., 2005) (Table 2), based on work in the context of the North Sea conferences (anon., 2002; Misund and Skjoldal, 2005) which had an important influence on early HELCOM and OSPAR work (JMM, 2003a, p. 4) and very similar to the procedural steps of the EU Marine Strategy Framework Directive (EUMSFD) (EU, 2008). Characteristic elements of this interpretation of the ecosystem approach are the stepwise implementation guidance, a kind of recipe, as well as Steps 3-5 in Table 2, which refer to the use of scientific modelling, monitoring and indicators to develop integrated quantitative definitions of ecosystem "quality", "integrity", "health" or "good status", which are in turn used to measure the achievement of environmental policy and law.

However, more generally, this notion can be considered as management via science and expertise, manifested in output such as assessments and indicators, whether on the ecosystems and environment or matters more related to human societies including economic or social benefits.

Table 2. *Seven steps to the Ecosystem Approach at a regional scale (Rice et al., 2005).*

Seven steps to implement ecosystem approach
Step 1. Scoping the current situation — Evaluate the ecosystem status. — Evaluate relevant ecosystem policies. — Compile inventory of human activities. — Evaluate relevant economic and social policies.
Step 2. Contrasting with the Vision
Step 3. Identifying important ecosystem properties and threats
Step 4. Setting ecological objectives
Step 5. Deriving operational objectives with indicators and reference points
Step 6. Ongoing management
Step 7. Periodic updates

The use of environmental or ecological quality, or 'immission',[12] targets implied by steps 3-5 of Table 1 as a basis for management, is a regulatory approach, which introduces more flexibility compared to environmental regulation based on technical measures and emission limits (Boeve and Van den Broek, 2012). The choices on specific measures to be applied in order to reach the set level of ecological quality are left to the responsible party, and in fact imply action only in cases where quality is at risk (Lübbe-Wolff, 2001). At least in Europe (Long, 2012), recent substantial efforts by the marine scientific community (Borja et al., 2016a, 2016b) to implement the EU Marine Strategy Framework Directive (EU, 2008), have equated the ecosystem approach with the implementation of such science-derived quantitative standards of ecological, ecosystem or environmental "quality", "good status", "health" or "integrity". In the ecosystem approach, at least according to some authors, such efforts of modelling and *quantifying* ecosystems should include the full complexity of interaction with human activities, not only the state of the ecosystem itself (Borja et al., 2016a, 2016b; Elliott, 2011; Elliott et al., 2017).

Such use of environmental quality standards, and flexible programmatic approaches to reaching them, is a prominent feature of EU environmental legislation (Boeve and Van den Broek, 2012), where they are used in parallel to more traditional technical regulation of emissions (Boeve and Van den Broek, 2012; Lübbe-Wolff, 2001). This approach, much like the use of economic incentives (e.g. Backer Johnsen et al., 2020), represent a move to a more self-regulative direction (Nilsson, 2006) and is also consistent with the principle of subsidiarity (Boeve and Van den Broek, 2012). While the EU Member States have a great deal of flexibility in choosing the exact measures to be taken (Boeve and Van den Broek, 2012)[13] there are some limitations as well as procedural requirements of coordination across policy areas (Boeve and Van den Broek, 2012).

Similar approaches to international environmental management using flexible science-based standards have a long history, reaching to the first half of the 20th century and even further back (Contini and Sand, 1972). Comprehensive quality-based environmental regulation was explicitly tested on the management of water ecosystems during 1970s in North America (anon., 1978; GLRAB, 1978). However, at least in the US, the early attempts led to unresolved debates on scientific uncertainties in courts and were eventually supplemented and in some ways bypassed with the use of the Best Available Technology (BAT) and the Best Environmental Practices (BEP)

[12] In legal literature these are sometimes called "immission standards" to distinguish from more traditional emission standards (Lübbe-Wolff, 2001). Traditionally immissions are used in environmental law e.g. in connection to the sic utere (Sic utere tuo ut alienum non laedas) principle to define a level of harm (Utter, 2007).

[13] As pointed out by Boeve and van den Broek (2012), besides flexibility in choosing the specific means of reaching these targets in many cases also the targets themselves have a degree of flexibility via provisions for deviations, delays, and other exit clauses.

concepts, the polluter pays principle and precautionary approaches in the 1990s (Houck, 2003). As pointed out by writers such as Ludwig et al. (1993) and more lately Mahon et al.(2009), the heavy emphasis on extensive scientific studies as a prerequisite for environmental management, inherent in the quality based regulation, can also be questioned in practical terms. Often measures can, and must, be taken in the absence of good scientific knowledge (Ludwig et al., 1993; Mahon et al., 2009).

The revived interest in the use of environmental quality during the 1990s (de Jong, 1992) may be partly explained by the scientific advances such as a greatly increased availability of monitoring data, e.g. via satellite instruments and remote sensing, and the modelling tools mentioned above. Another factor was the need for more advanced policy tools in sea areas such as the Baltic Sea, where major pollution sources have been successfully abated and the remaining diffuse pollution sources (e.g. agriculture) are politically contentious, requiring further justification of the necessary spending (Backer and Leppänen, 2012; HELCOM, 2003a). However, the popularity of quality based regulation may well also reflect other factors such as the general political preferences for more flexible environmental regulation during the last decades (Bernstein, 2000) and even UK influence on EU environmental policy (Lübbe-Wolff, 2001).

A conceptual framework

The ecosystem approach may naturally also include some elements which are not captured by the two themes based on Waylen et al (2014) and as juxtaposed above. Such other meanings, and the validity of the duality described above, can be studied through key characteristics of the ecosystem approach identified in the targeted literature reviews, which can in turn be used to further outline the substance of the concept in a general sense (De Lucia, 2019; Long et al., 2015; Waylen et al., 2014). Some examples from different time periods of this kind of analysis, based on comprehensive literature reviews, are presented in Table 3, namely by Lee et al (1982), Grumbine (1994), Trouwborst (2009), Long et al.(2015) & Kirkfeldt (2019), identifying key features of the ecosystem approach from a large number of sources and across different variants (e.g. EA/EBM/EBA) of the term (Table 3). Such characteristics can further be used to test the two categories derived from Waylen via tabulation (Table 4)

The two outlined themes of ecosystem approach from Waylen et al. (2014): the development of new cooperation structures and processes which would enable integration, and more efficient interaction, between different sectoral management regimes (“EA as integration”); as well as defining and monitoring progress toward attaining a desired level of ecosystem status defined by some sort of objective “eco-standards” (“EA as quantification”), can be combined with the adaptive management (cf. Table 4) for a basic conceptual framework of the Ecosystem Approach in international policy and law (Figure 1). While some elements, such as the importance of human values to management

(Table 4), might not fit into this simple framework, it is proposed as a heuristic for the purposes of structuring this thesis.

Adaptive management should permeate implementation processes, and it is related to the cyclical management approach inherent in the Drivers-Pressures-State-Impact-Responses (DPSIR) concept (Rapport and Friend, 1979), and its derivations such as the recent DAPSI(W)R(M)[14] (Elliott et al., 2017). Problem structuring frameworks like the DPSIR are useful to clarify the causes and consequences of, and responses to, complex environmental issues -which are needed by adaptive, integrated management and thus also implementation of the ecosystem approach (Elliott et al., 2017).

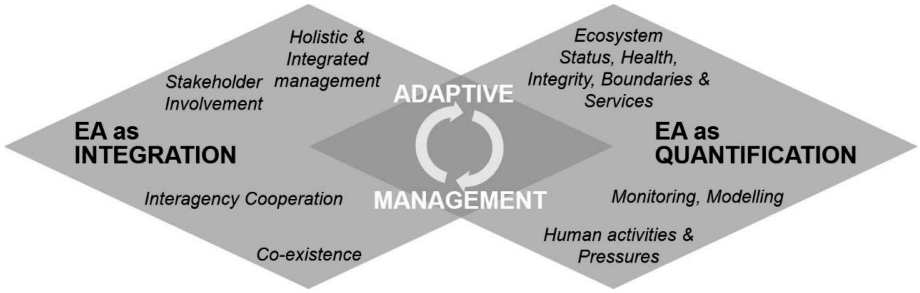

Figure 1 A proposed conceptual framework of the main elements of the Ecosystem Approach based on (Waylen et al., 2014) and Table 4. The main constitution themes are Ecosystem Approach as policy integration (left side) and as scientific quantification (right side) which are both present in most conceptions of EA. Adaptive management is seen as a key dynamic element permeating an EA implementation process.

[14] As described by the authors: "The Drivers of basic human needs require Activities which lead to Pressures. The Pressures are the mechanisms of State change on the natural system which then leads to Impacts (on human Welfare). Those then require Responses (as Measures)" (Elliott et al., 2017, p. 1).

Table 3. *Examples of characteristics of the Ecosystem Approach, identified by researchers via comprehensive literature reviews, interview studies of experts and case study overviews. Numbering in square brackets added for the characteristics from Long et al. (2015) and Kirkfeldt (2019).*

Reference	Identified headings of characteristics/key principles of Ecosystem Approach	Method
(Lee et al., 1982)	1. a focus primarily on ecological phenomena, rather than on the conventional and historically dominant political, engineering, economic, or accounting perceptions; 2. spatial boundaries within which management plans are formulated, which reflect some aspect of ecological integrity within the boundaries; 3. a balanced, integrated combination of mapping, monitoring, modelling, and adaptive management case studies to convey, analyze, and update ecosystem information; 4. cohesive, self-regulatory structure and function of ecosystems involving stable phases or states of equilibrium, and thresholds or limits of stress tolerance of those states; and 5. ecosystem response to (i.e., change from) human activities, with responses to different uses often interacting synergistically.	Study of case studies in the catchment of the N. American Great Lakes
(Grumbine, 1994)	1. Hierarchical Context, 2. Ecological Boundaries, 3. Ecological Integrity, 4. Data collection, 5. Monitoring, 6. Adaptive management, 7. Interagency cooperation, 8. Organizational Change, 9. Humans Embedded in Nature & 10. Values	Literature review of scholarly papers
(Trouwborst, 2009)	(1) the holistic management of human activities (2) based on the best available knowledge on the components, structure and dynamics of ecosystems, (3) and aimed at satisfying human needs in a way that does not compromise the integrity, or health, of ecosystems.	Analysis of policy and legal material
(Long et al., 2015)	(Characteristics ordered according to decreasing importance) [1] Consider Ecosystem Connections, [2]Appropriate Spatial & Temporal Scales, [3] Adaptive Management, [4] Use of Scientific Knowledge, [5] Integrated Management, [6] Stakeholder Involvement, [7] Account for Dynamic Nature of Ecosystems, [8] Ecological Integrity & Biodiversity, [9] Sustainability, [10] Recognise Coupled Social-Ecological Systems, [11] Decisions reflect Societal Choice, [12] Distinct Boundaries, [13] Interdisciplinarity, [14] Appropriate Monitoring, and [15] Acknowledge Uncertainty	Literature review of scholarly papers (frequency analysis)
(Kirkfeldt, 2019)	(objectives shared by EA, EBA and EBM in Fig1, p.6): [1] Ecosystem health, [2] Economic benefits, [3] Societal benefits, [4] Conservation, [5] Sustainability. (objectives shared by EA & EBM): [6] Ecosystem/Environmental management, [7] Guiding action, [8] human well-being, objectives shared by EBA & EBM):[9] natural resource management; (objective of EBM only:) [10] co-existence, (objectives of EBA only:) [11] impact management & [12] Good Environmental Status	Coding of literature review of scholarly papers & interviews of MSP practitioners

Table 4. *Illustration of the characteristics of ecosystem approach elements considered as "integration" and "quantification" in this thesis via grouping and tabulation of the findings of other authors. The characteristics of the Ecosystem Approach highlighted have been identified by researchers via comprehensive literature reviews, interview studies of experts and case study overviews. Numbering in square brackets added for the characteristics from Long et al. (2015) and Kirkfeldt (2019).*

Citation	EA elements considered as "Integration"	EA elements considered as "Quantification"	Other elements
(Lee et al., 1982)	-	1. A focus primarily on ecological phenomena, rather than on the conventional and historically dominant political, engineering, economic, or accounting perceptions; 2. spatial boundaries within which management plans are formulated, which reflect some aspect of ecological integrity within the boundaries; 3. a balanced, integrated combination of mapping, monitoring, modelling, and adaptive management case studies to convey, analyze, and update ecosystem information; 4. cohesive, self-regulatory structure and function of ecosystems involving stable phases or states of equilibrium, and thresholds or limits of stress tolerance of those states; 5. ecosystem response to (i.e., change from) human activities, with responses to different uses often interacting synergistically.	
(Grumbine, 1994)	7. Interagency cooperation, 8. Organizational Change	1. Hierarchical Context [Ed.: meaning that focus should be simultaneously given to all levels of biodiversity hierarchy (genes, species, populations, ecosystems, landscapes)], 2. Ecological Boundaries, 3. Ecological Integrity, 4. Data collection, 5. Monitoring, 9. Humans Embedded in Nature	6. Adaptive management, 10. Values
(Trouw-borst, 2009)	(1) The holistic management of human activities	(2) Based on the best available knowledge on the components, structure, and dynamics of ecosystems, and (3) aimed at satisfying human needs in a way that does not compromise the *integrity, or health*, of ecosystems.	
(Long et al., 2015)	[5] Integrated Management, [6] Stakeholder Involvement, [11] Decisions reflect Societal Choice, [13] Interdisciplinarity (could also qualify as "quantification")	[1] Consider Ecosystem Connections, [2] Appropriate Spatial & Temporal Scales, [4] Use of Scientific Knowledge, [7] Account for Dynamic Nature of Ecosystems, [8] Ecological Integrity & Biodiversity, [9], Sustainability, [10] Recognise Coupled Social-Ecological Systems, [12] Distinct Boundaries, [14] Appropriate Monitoring, and [15] Acknowledge Uncertainty	[3] Adaptive Management
(Kirkfeldt, 2019)	(*objective of EBM only*:) [10] co-existence,	(*objectives shared by EA, EBA and EBM in Fig1, p.6*): [1] Ecosystem health, [2] Economic benefits, [3] Societal benefits, [4] Conservation, [5] Sustainability. (*objectives shared by EA & EBM*): [6] Ecosystem/Environmental management, [7] Guiding action, [8] human well-being, (*objectives shared by EBA & EBM*):[9] natural resource management; (*objectives of EBA only*:) [11] impact management & [12] Good Environmental Status	

EA as international law

While some conceptual elements of the substantial content of the ecosystem approach can be outlined, as was done above, opinions commonly diverge even more as one starts the work to define in public what the concept would means, in the concrete, in terms of legally binding commitments and measures on the ground (De Lucia, 2019; Platjouw, 2016; Sander, 2018; Söderström, 2017, p. 41). When referred to – in policy documents or even in law (EU, 2008) – the concept is commonly left undefined.

The legal and substantial vagueness of the ecosystem approach is a fairly typical situation for international law on the environment (Boyle, 2006). Even if environmental degradation are considered as scientific facts (HELCOM, 2019; UN Environment, 2019), characteristic features of international environmental law include vague formulations and procedural commitments, leading to rightful questions on enforceability (Boyle, 2006; Koskenniemi, 1993). Klabbers (2013) refers to such vagueness as "constructive ambiguity", as it manifests a compromise reached between states and competing interests and functions as a conceptual bridge between conflicting interests. The necessary concreteness is assumed to emerge from regular cooperation to implement an agreement (Brunnée, 2002; Gehring, 2007), including technical working groups dedicated to specific areas of expertise.

Such regular cooperation on environmental matters rely on new technology and scientific knowledge, to identify and solve issues, as well as on conceptual developments such as the ecosystem approach, to keep the work alive and up to date. Findings of scientific research and technological developments have been essential to the development of international environmental policy and law (Andresen and Skjaerseth, 2007, p. 186; Bocking, 2004), also in the Baltic Sea and HELCOM (The Stockholm Environment Institute, 1990; Wulff, 2007). The remaining conceptual innovations have been divided by Dworkin (1967) to law consisting of legal rules and some rule-like legal principles (interpretative aid), as well as the category of policy consisting concepts not falling under these two. In many cases the division between the two is not clear cut (Beyerlin, 2007) and a number of concepts are for this reason referred to as being in the process of becoming law,[15] *soft law* (Boyle, 2006) or more poetically as *twilight norms* (Beyerlin, 2007).

Even if the legal nature of the ecosystem approach remains unsettled (De Lucia, 2019; Langlet and Rayfuse, 2018a; Platjouw, 2016), it seems reasonable to assume that, via the inclusion to legal frameworks and subsequent implementation work, it has developed from a mere policy to one of the twilight norms of Beyerlin (2007). However, the concept makes intuitive sense to Langlet & Rayfuse (2018a) they find it challenging to implement. They also highlight that it is not explicitly defined in EU legislation nor is the terminology fixed (Langlet and Rayfuse, 2018a, p. 446). De Lucia (2019) does not directly attribute the concept with specific degree of legality. However, he

[15] referred to as *lex ferenda* (future law), to distinguish from *lex lata (*existing law)

points out that in the CBD framework the ecosystem approach is explicitly considered as a non-binding policy concept (De Lucia, 2019, p. 184). Platjouw (2016) grants the ecosystem approach a guiding function to be used when applying *administrative* discretion. Simultaneously, she questions the value of this function as it adds to the unpredictability of the resulting decisions, like adaptive management (Platjouw, 2016).

The dimension of adaptive management and the diversity of particular contexts might mean that no universal definitions are even desirable (e.g. Bohman, 2018, p. 87) or at least warrant for an approach where the final specifications are done at regional, national and even municipal scales and not at a global level (Langlet and Rayfuse, 2018a, p. 447).

2.3 EA, REGIONAL SEAS AND HELCOM

Regional seas organisations, international cooperation focusing on the marine environment of a specific sea area with origins in the immediate follow-up of the 1972 Stockholm Conference (UN, 1973), have been active and remain important in the implementation of the ecosystem approach concept at sea (Mahon and Fanning, 2019; UNEP, 2013). This kind of cooperation between coastal and other concerned states consists of permanent cooperation structures, including the 13 UNEP[16] administered regional seas programmes and action plans and the 5 independent regional seas organisations including HELCOM and OSPAR (UNEP, 2013). Annual meetings of the regional seas organisations are organised by the UN Environment to develop this synergy between regional and global work. Regional cooperation relevant for the marine management and governance also takes place within Regional Fisheries Management Organizations (RFMOs) coordinated by FAO, Port State Control MoUs under IMO as well as various time bound initiatives and projects (Mahon and Fanning, 2019). The latter includes for example the numerous Large Marine Ecosystem (LME) projects funded by the International Waters focal area of the Global Environment Facility (GEF) (Sherman et al., 2005; Sherman and Duda, 1999; UNEP, 2013), also covering areas without formal regional sea organisations.

The last decade of work within the subset of regional seas organisations which include European Union (EU) member states, at least in the Baltic (HELCOM), North-East Atlantic (OSPAR), Mediterranean regions (UNEP MAP) and the Black Sea Commissions, provide some particularly clear examples of regional processes to implement the ecosystem approach. As the EU Marine Strategy Framework Directive (EU MSFD) (EU, 2008) gives the regional seas organisations an explicit role as coordination platforms of national implementation, these organisations have been involved in the implementation of the directive which is explicitly based on the ecosystem

[16] United Nations Environment Programme (UNEP), currently called UN-Environment

approach and links the concept, at least implicitly, to the work on defining targets of environmental quality. This has led to rearrangements of working structures and core activities (Long, 2012).

The Helsinki Commission (HELCOM), focusing on the Baltic Sea in Northern Europe, is one of the independent regional sea organisations participating in the UNEP network. It was formally established in 1980 by the entry into force of the original 1974 Convention on the Protection of the Marine Environment of the Baltic Sea Area, or Helsinki Convention (revised in 1992).[17] Since the start this work has included both a decision-making body as well as technical subsidiary bodies, the latter providing substantial expertise from the start and input for the decision making process (e.g. Hjorth, 1994). The work of the organisation has been described (Backer and Leppänen, 2012) as having experienced at least three distinct phases, where the work on ecosystem approach implementation (2003-) has been the latest.[18]

In 2003, because of international and European developments, HELCOM adopted the ecosystem approach as a new management concept (JMM, 2003b). The 2003 Meeting defined the ecosystem approach as follows:

> *"...the ecosystem approach is based on an integrated management of all human activities impacting on the marine environment and, based on best available scientific knowledge about the ecosystem and its dynamics, identifies and leads to actions improving the health of the marine ecosystem thus supporting sustainable use of ecosystem goods and services."*
>
> *(JMM, 2003a)*

This definition can be used to further develop the general conceptual framework on the ecosystem approach presented in Figure 1 to a HELCOM - specific version. The 2003 HELCOM-OSPAR definition of the ecosystem approach highlights the concept of integrated management ("integration") as well as the best available scientific knowledge and health of the marine ecosystem ("quantification"). However, the HELCOM definition also points at a third element, namely that the management based on ecosystem approach should identify, and lead to, management action. In order to include this element, the general conceptual framework presented in Figure 1 can be developed further to better reflect the HELCOM context with the inclusion of *measures* (Figure 2), which is a term used in the EU MSFD and other EU

[17] HELCOM was preceded by six years of regular work within the Interim Commission (IC), starting immediately after the signing of the Helsinki Convention in 1974 and continuing until 1980.

[18] The first was the early work 1970s-1980s, influenced by the cold war and with a focus on sea-based pollution (maritime transportation and oil pollution) due to sensibilities related to coastal waters. This was followed by the period of the 1990s, influenced by the 1992 UNCED and characterised by the inclusion of biodiversity & nature conservation as well as addressing pollution sources on land.

Directives to specify how management to improve the status of the environment will be carried out (Grant and Elliott, 2018).

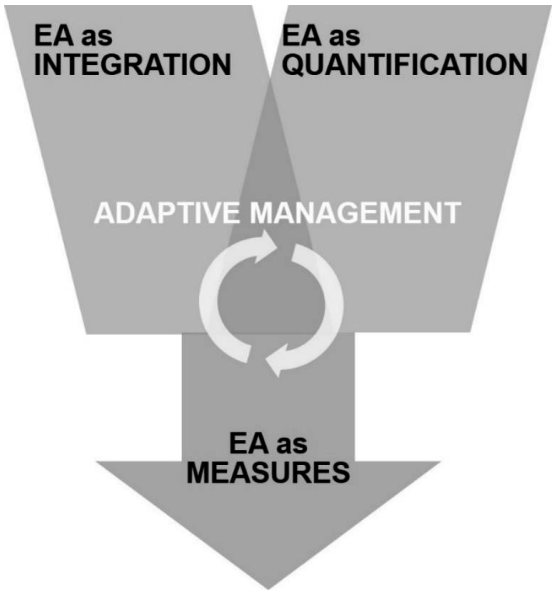

Figure 2 Conceptual model of the main themes of ecosystem approach in the HELCOM context. The main components are Ecosystem approach (EA) as policy integration (upper left) and as quantification (upper right), including traditional environmental monitoring, modelling as well as other types of data such as economic information. The third element is EA as measures, or concrete attempts to reduce pollution improve the status of the environment in some other way. As in the general model, adaptive management is seen as a key dynamic element which permeates an implementation process.

The HELCOM adoption of the Ecosystem Approach was partly a follow-up by the coastal countries to a commitment included in the outcome of the 2002 World Summit on Sustainable Development (WSSD), to implement the ecosystem approach by 2010. It was also related to the developments around the EU Marine Strategy launched in 2002 (EC, 2002), which would result in the 2008 adoption of the EU MSFD (EU, 2008) and naturally subsequent implementation work by the EU member states.

Today, after nearly two decades of HELCOM implementation efforts, the concept remains in use, but the organisation has made few if any efforts since the original adoption in 2003 to formalise the status of the ecosystem approach further. For example, the Ecosystem Approach has not been included in the 1992 Helsinki Convention[19] and there is neither a dedicated

[19] HELCOM, "Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki 9 April 1992, in Force 17 January 2000)."

HELCOM Recommendation, the main form of treaty body output, on implementation of the ecosystem approach. The obligation to promote the ecological restoration of the Baltic Sea Area and the preservation of its ecological balance[20] in the original Article 3.1 on Fundamental Principles and Obligations has been suggested as a conceptual link to the ecosystem approach by Bohman (2018), but this link is not particularly strong. Thus, even if the ecosystem approach has resulted in a very concrete implementation process, its legal status remains nearly as unsettled within HELCOM as elsewhere. In the HELCOM context the ecosystem approach is also practically a synonym, perhaps even a euphemism, for the implementation of the EU MSFD.[21]

2.4 THE RESEARCH CONTEXT AND GAP

After the above general introduction to the topic of the ecosystem approach, and the derivation of a conceptual framework for ecosystem approach implementation within HELCOM (Figure 2) this section will outline the specific research context for this thesis via a review of key studies (Bohman, 2018, 2017; Hassler et al., 2013; Hegland et al., 2015; Langlet and Rayfuse, 2018a; Linke et al., 2014; Ringbom and Joas, 2018; Söderström, 2017; Söderström and Kern, 2017; Valman, 2014), considered to contain the main strands of the current discourse on the subject of ecosystem approach implementation within HELCOM. In the end of this section there will be an attempt for a synthesis and conceptual interpretation of their findings as well as identification of the research gap to be filled by this thesis.

Even if the implementation of the ecosystem approach within the Baltic Sea and HELCOM includes ecosystem modelling and assessments (Andersen et al., 2015, 2011; Jansson, 1972; Korpinen et al., 2012; Möllmann et al., 2013; Savchuk, 2018; Wulff, 2007) the technical details of this interesting strand are somewhat off the focus of this thesis. Due to this such studies are referred to only in passing later, when discussing the results of the articles I-V.

Of the reviewed studies, the work by Valman (2014) is closest to the aims of this thesis. Valman used content analysis on HELCOM meeting records 1980-2013 as well as interviews to outline the origin and evolution of

[20] Article 3.1. "*The Contracting Parties shall individually or jointly take all appropriate legislative, administrative or other relevant measures to prevent and eliminate pollution in order to promote the ecological restoration of the Baltic Sea Area and the preservation of its ecological balance*." Note that the original convention of 1974 does not include any such ecosystem aims and its Article 3.1. simply calls "*The Contracting Parties shall individually or jointly take all appropriate legislative, administrative or other relevant measures in order to prevent and abate pollution and to protect and enhance the marine environment of the Baltic Sea Area**.

[21] Cf. the use of the ecosystem approach in the full name of the GEAR group, *Group for the Implementation of the Ecosystem Approach*, with main task to coordinate EU MSFD implementation in the region (HELCOM, 2014).

HELCOM cooperation with a particular focus on the 2007 BSAP. Based on the results (Valman, 2016, 2015, 2013; Valman et al., 2016) she highlights that while BSAP and ecosystem approach implementation introduced new regulatory tools (particularly the quality-based reduction targets for nutrient pollution), new themes and to a certain extent new language, no rapid changes were detected in HELCOM as an institution, as the main changes could be traced to 1990s or earlier (Valman, 2014, pp. 43–47). Valman finally suggests that implementing deeper institutional changes, including adaptive management, could enable drawing more benefits from the implementation of the ecosystem approach (Valman, 2014, p. 53), a point which is difficult to disagree with in a general sense.

The findings of the remaining studies can be grouped, according to the conceptual framework provided in Figure 2, to the themes of integration, quantification and measures, as described above.

Integration

Söderström (2017) analysed the use of the ecosystem approach in the existing arrangements for Baltic Sea environmental governance via a literature review and interviews, including but not limiting to HELCOM. Based on the results, she is of the opinion that the regional implementation of the ecosystem approach concept, in a later study (Söderström and Kern, 2017) specified as to consist of five elements (i)a holistic approach with human inclusion, (ii) scale dependency and integration, (iii) sound science, (iv) participation and (v) adaptive management and ecosystem services, can be confirmed in regional cooperation at large. As others (e.g. Article II of this thesis) she further highlights that implementation has consisted of Europeanisation via work on the EU relevant directives (MSFD and WFD), regionalisation via the activities of HELCOM and that more developed cross-sectoral and holistic management would be important to transform the ecosystem approach from a mere policy principle to concrete management measures (Söderström, 2017).

Hegland et al (2015) focus on two specific HELCOM bodies, the GEAR group on MSFD implementation and the Fisheries-Environment group, to study policy integration as part of ecosystem approach implementation, as well as regionalisation of EU policies. They highlight that while some of the institutional links needed for integrated decision making are strong (e.g. IMO-HELCOM) some of them remain de-facto weak (Baltfish-HELCOM) or even non-existing, as in the case of environmental effects of renewable energy developments (Hegland et al., 2015, pp. 20–21). While they consider stakeholder participation as weak within the studied groups the meeting records of the HELCOM fish group 2015-2018, as well as my own practical experiences, seem to disagree with this finding, possibly indicating that they are referring to the state of affairs before 2012 (Hegland et al., 2015, p. 16).

With a focus on HELCOM and ICES contexts, Hassler et al (2013) observe two main types of ecosystem approach conceptions in the Baltic Sea: one management oriented (focus on interactions between ecological and social

systems) and another expert-oriented (focus on the ecosystems themselves), similar to the two main EA themes given in Figure 2. They point out that even if the expert oriented definition is complemented with economic information and models this step does not address the political, social and cultural dilemmas which are not reasonably quantifiable but are central to successful implementation (Hassler et al., 2013, p. 235). They call for a more adaptive approach to avoid new negative lock-in effects which could result from a superficial ecosystem approach implementation (Hassler et al., 2013, p. 240).

Quantification & Measures

With special focus on eutrophication, Bohman (2017) is of the view that while the quality-based policy targets adopted with the ecosystem approach and BSAP are an innovative legal framework and potentially ambitious, traditional sectoral measures might be more efficient due to the lengthy time lags in ecosystem response to reduction in nutrient pollution loads (Bohman, 2017). She also points out that the resulting failure (Murray, 2019) of reaching the agreed quality targets for eutrophication by the target year 2021 undermines their practical value (Bohman, 2017, p. 377). In another publication, Bohman (2018) highlights the value of the collective learning enabled by the work on assessments and indicators as part of ecosystem approach implementation. She also sees this work to provide the basis for a process of *managerial compliance*, the use of administrational powers to facilitate the implementation, as potentially more effective than formal international agreements. According to her, this process also has enabled discussions on measures which were traditionally beyond the HELCOM mandate (Bohman, 2018, p. 108). Given the significant resources invested in the defining the quality targets EU-wide it seems sensible study a bit further the relationship between measures and ecosystem approach implementation.

Finally, Ringbom & Joas (2018) point out the general tendency of the increasing use of generic, process oriented, rules with mandatory but imprecise goals and a corresponding decrease in traditional "command-and-control" rules targeting specific substances or activities the Baltic Sea region (Ringbom and Joas, 2018, pp. 321–322). They further highlight the risks that this shift implies for traditional technical rules which remain important especially in some issues (Ringbom and Joas, 2018, p. 322), even if suitable high-impact targets for this type of regulation are more and more difficult to find (Ringbom and Joas, 2018, p. 323).

Synthesis

Concludingly, these published studies seem to indicate that implementation of the ecosystem approach within the HELCOM context has led to a change on the conceptual level of organizational language (including e.g. the terminology used) (Valman, 2014) and the holistic management agenda (Hassler et al., 2013; Söderström, 2017; Valman, 2014), as well as in terms of work on environmental quality standards and assessments (Bohman,

2018, 2017) and regionalization of EU commitments (Bohman, 2018; Hassler et al., 2013; Hegland et al., 2015; Ringbom and Joas, 2018; Söderström, 2017). As a positive element Bohman also highlights the managerial compliance created by the boundary work on HELCOM quality standards and related assessments (Bohman, 2018). At the same time Bohman join Ringbom & Joas (2018) and Hassler et al. (2013) in pointing out the risks of replacing specific technical rules with goal oriented approaches.

In contrast, these studies seem to be less convinced that the ecosystem approach implementation has led to deeper institutional changes within HELCOM (Hassler et al., 2013; Hegland et al., 2015; Söderström, 2017; Valman, 2014) or in fully functional cross-sectoral cooperation and stakeholder involvement (Hassler et al., 2013; Hegland et al., 2015; Söderström, 2017).

Research gap to be addressed

In her PhD thesis Valman found that no rapid changes were detected in HELCOM as an institution following the 2007 Baltic Sea Action Plan as the main changes could be traced to 1990s or earlier (Valman, 2014, pp. 43–47). However, my own practical experiences with the organisation[22] indicated that what could be considered as significant changes in HELCOM groups and meetings had taken place toward the end of, and after, the period studied by Valman – as increased number of meetings, participation and new thematic substance. Further I know that substantial effort in cross-sectoral management, reminiscent to that called for by Söderström (2017) and Hegland et al. (2015), had been implemented within HELCOM during the same period, it called for further study. Finally, Valman (2014) or the others have not, at least explicitly, attempted to outline the ecosystem approach concept itself as implemented by HELCOM. I also considered this latter aim to be worthwhile in contributing to the general understanding of the concept by providing a case study from a regional sea organization.

[22] The condidate was employed by the HECOM Secretariat 2004-2018.

3 AIMS AND OBJECTIVES

The overall objectives of this thesis are to:

- conclude whether HELCOM has implemented the ecosystem approach during 2003-2018.
- identify the specific features of the ecosystem approach concept as documented and implemented within HELCOM during 2003-2018 by proposing and using a conceptual framework for the ecosystem approach consisting of the three themes of quantification, integration, and measures (Figure 2);
- examine whether HELCOM work has changed during the 2003-2018, if so how, and whether observed changes can be attributed to the implementation of the ecosystem approach.

The ultimate aims of the study are to provide an implicit local interpretation of the ecosystem approach concept as well as lessons learned from implementing it, to research and management initiatives worldwide.

The research to conclude on the overall objectives is documented in this summary as well as in five Articles (I-V). Four of the Articles (I-IV) are published case studies which intend to give in-depth information on specific dimensions of the implementation of the ecosystem approach within HELCOM. Article V (still in manuscript form) provides the necessary links and overview of the evolution of the entire HELCOM cooperation during 2003-2018.

The specific objectives of the Articles are as follows:

Article I. Describe and reflect on the background, the execution, and the results of the work 2004-2006 by authors and colleagues to draft concepts for, and facilitate final agreement on, the HELCOM vision, strategic goals and ecological objectives as the first steps in the implementation of the ecosystem approach as quantification of the desired state of the Baltic Sea ecosystem and the subsequent process of defining and assessing its status. (Article I).

Article II. Analyse the preparation, execution, and results of the work 2003-2007 by authors and colleagues to draft concepts for, and facilitate the final agreement on, the 2007 HELCOM Baltic Sea Action Plan (BSAP) both as the implementation of the ecosystem approach at large, a targeted programme of measures and as a pilot of the EU marine Strategy Framework Directive adopted in 2008 (Article II).

Article III. Study and reveal the work 2006-2010 by the author and colleagues to draft concepts for, and facilitate final agreement

on, the implementation of the ecosystem approach as policy integration via Marine/Maritime Spatial Planning (MSP). This is provided as an example of policy integration in terms of cross-sectorial work, expanding cooperation with professional groups and epistemic communities less involved in preceding HELCOM work. (Article III).

Article IV. Elucidate the work by the author, 2012-2018, and colleagues (since the 1980s) to draft concepts for, and facilitate final agreement on, HELCOM initiatives to reduce operational pollution from ships in the Baltic Sea area via environmental regulation of shipping at IMO, as an example of concrete management measures catalysed by the process of ecosystem approach implementation (Article IV).

Article V. Complete the overall picture with a study (archival work completed 2019-2020) on the potential effect of the ecosystem approach, including the themes of quantification, integration and measures, in the work within HELCOM 2003-2018 at an organisational level with the help of a comprehensive metadata study on HELCOM meetings and decisions based on the official HELCOM document archive (Article V).

Figure 3 provides an attempt to visualise the relationship between the content of Articles I-V and the conceptual framework of HELCOM ecosystem approach proposed in Figure 2.

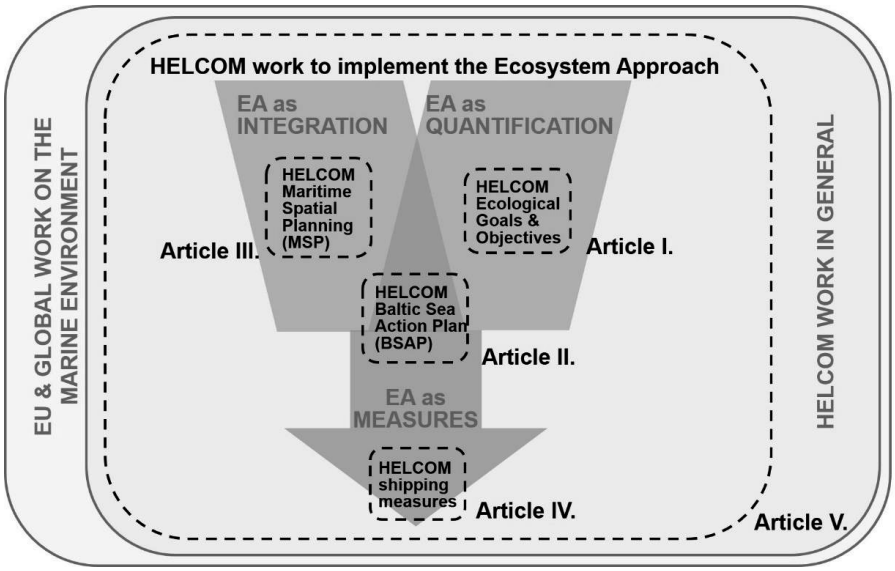

Figure 3 Conceptual frame of the thesis, presenting the thematic focus of Articles I-V as well as their internal relations.

4 MATERIAL & METHODS

The four case studies (Articles I-IV) are first-hand accounts of HELCOM policy processes, enriched by in-depth reviews of available literature, meeting reports as well as first-hand knowledge from drafting the specific documents and facilitating the related meetings. The policy documents discussed in articles I-IV have been submitted, discussed, and amended in technical HELCOM meetings, typically several such meetings. The final decision has been taken at a meeting of the HELCOM Heads of Delegations (HODs) or annual Helsinki Commission. The discussions and decisions at, as well as participation in these Meetings have been recorded in official meeting records which are freely available from HELCOM online archive for further study. Please note that records from older meetings are not comprehensively available online and have to be retrieved from internal Secretariat archives in digital or hardcopy form.

As the underlying work for this thesis and the first Article was initiated already 15 years ago and the first article was submitted in 2006, it is recognised that not all of the conclusions in the first three Articles (published 2007, 2010 and 2011) are relevant today and especially in light of later studies by others. However, as first-hand accounts of completed work the Articles I-IV should retain their value as a testimony and state of knowledge at the time of writing.

For the purposes of Article V, three sets of research material were extracted to study the characteristics and evolution of HELCOM work during the 2003-2018 implementation of the ecosystem approach concept:

The first set of research material was an expertise-based extraction of general developments and key aspects of the HELCOM ecosystem approach from ministerial meeting outcomes during 2003-2018, thus providing overall information on the evolution of the concept.

The second set of research material was a comprehensive quantitative (meta-) dataset covering meeting topic, attendance as well as start and end times of all the 724 HELCOM meetings which took place during 2003-2018 and have records or mentions in the official or internal archives. This material enabled to study how the HELCOM meeting machinery has evolved, with possible influence from the implementation of the ecosystem approach. The author's knowledge on the HELCOM working groups enabled grouping of the meetings based on their actual content, rather than by name or their place in the organizational hierarchy of HELCOM.

The third set of research material was a compilation of all documents which have been referred to as adopted, endorsed or similarly agreed by the decision-making bodies (Helsinki Commission annual meeting as well as the HELCOM Heads of Delegation) during 2003-2018, enabling the study of what kind of output the regional cooperation produced during the period. This resulted in the identification of 383 distinct adopted/endorsed HELCOM documents

2003-2018, which were categorised to two main types: “measures” and “assessments”. See study V for more details on the methodology utilized and choices taken in the process of extracting these datasets.

The second type of data on the topic, on attendance as well as start and end times of all the HELCOM-related meetings during the studied period, was used to estimating *person hours in meetings* by topic as follows:

(1) person hours in meeting = number of participating persons × recorded meeting duration (hours)

This quantity was used in the fifth article as a proxy to estimate annual work effort within the HELCOM cooperation, both in total and by topic.

This is an unusual way to use meeting records of international organizations in research, justifying some further reflection. The approach emerged as the only practical way to generate a relatively homogenous time series of the work done within HELCOM as reliable records of meeting times and participation are available as part of the official meeting records (“Minutes” or “Outcomes”). Alternative reliable sources of information, such as studying budgets and expenses of national institutions of nine coastal countries and the EU to trace the contributions to HELCOM works, or interviewing participants about their time use post-hoc was considered as meaningless due to the 15-year timespan involved. It is also acknowledged that such meeting participation also involves preparatory work not covered by this type of data. But as the degree of preparation likely varies to a large degree between organizations and individuals the inclusion of this information is very challenging to estimate reliably.

The selected quantity is used with the conviction emerging from practical experience that the indirect investment in terms of expert working time, allocated to HELCOM meetings and the necessary preparatory work, is a very, if not the most, significant contribution the contracting parties and observers are making to the practical work of the organization. For this same reason budgetary information was considered as inadequate as it captures only funds available for the Secretariat. Further, the data also reflects national priorities and interests as decisions by countries and observer organizations to send delegates to HELCOM meetings are connected to them. Finally, based on my own practical experience, these meetings are neither a form of displacement activity, at least not at the general level discussed in this thesis, but represent real efforts by the participants to create regional understanding and agreements on the matters under discussion, both during the actual meeting and in informal discussions over coffee.

Even if measuring outcomes (e.g. the results of the national implementation of measures agreed at HELCOM) would be a more direct way to study the concrete effects of HELCOM ecosystem approach, this was not possible within the frame of this work. Even if HELCOM has collected and

published (HELCOM, 2018a) information on the national implementation of management measures using a checklist approach (e.g. "The implementation of Measure X has been completed/started/not started"), the general wording of many measures limit the usefulness of this information. More comprehensive overviews of the actual details of what such implementation has concretely entailed would require extensive studies of national documents in the original languages.

Personal note

Perhaps somewhat unconventionally for research, this thesis is a result of an intellectual exploration to my daily work at the HELCOM Secretariat 2004-2018, where my tasks were directly related to Articles I-V and this summary. Thus, I have a very direct relationship with the topic of this thesis. My professional role in developing the processes documented and discussed in the publications I-V means that I have *de facto* been engaged both as an investigator/observer and, together with my colleagues, as a co-originator of the research object. Further, the work and reflection needed to produce the topic of the publications have been implemented in the on-going work. The implementation of the ecosystem approach within HELCOM has also been a learning process where I have been confronted with a theoretical concept and made efforts to use best available knowledge to transform it to functional solutions, as well as reflected on the results over a 15-year period.

Nevertheless, instead of the classical positive science model, where the scientist is detached from her/his study object, especially the publications I-IV use a general methodological research framework which is in engineering (information) sciences and in the field of design known as design research or design science research[23] or in social sciences as insider action research.[24] Under this research model the researcher generates new knowledge through defining a problem and planning an intervention, doing the intervention or testing/proposing a solution – often involving the creation of theoretical concept, process or physical object – evaluating the results and finally reflecting on, and learning from, the whole process.[25] This process can naturally lead to new research questions indicating cyclical knowledge generation (Figure 4).

This said, I was not employed by the organization 2019-2020 when writing this summary as well as Article V. This has enabled a step back from a civil servant role to a more traditional research role and taking another, more

[23] A. Hevner et al., "Design Science in Information Systems Research," *MIS Quarterly* 28, no. 1 (2004).

[24] Kathryn Herr and Gary L. Anderson, *The Action Research Dissertation* (Sage Publications, Inc., 2005); David Coghlan, "Insider Action Research Doctorates: Generating Actionable Results," *Higher Education* 54(2007).

[25] An example of a PhD study at the University of Helsinki using this methodology is: Ulla Rosenström, "Sustainable Development Indicators: Much Wanted, Less Used?," *Monographs of the Boreal Environment Research* 33(2009).

distant, look at my past work. In addition, even during my employment at HELCOM, I was not involved in all the activities related to the ecosystem approach implementation, and in many activities only marginally.

Regardless of the epistemological model applied to define the generation of new knowledge, objectivity in the form of honesty and integrity are cornerstones of any research work. For the purposes of this thesis, upholding standards of objectivity is naturally a challenge due to my personal involvement in creating the research object. I fully recognise these challenges and have made my best efforts to adhering to them along the way.

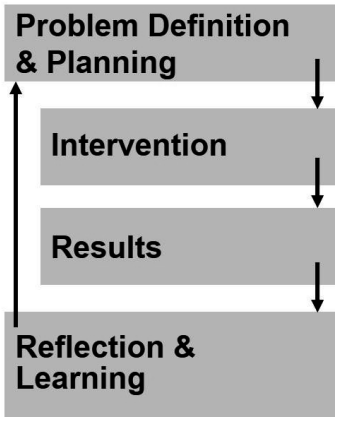

Figure 4 The Action Research/ Design Research method [26]

[26] Maung K. Sein et al., "Action Design Research," *MIS Quarterly* 35, no. 1 (2011).

5 RESULTS

5.1 GENERAL OBSERVATIONS (ARTICLES I-V, CHAPTER 2)

The initial launch of the Ecosystem Approach implementation in the HELCOM framework was done via three different outcomes of the 2003 ministerial meetings in Bremen: the Joint HELCOM-OSPAR ministerial meeting (JMM) outcome, the joint statement on the Ecosystem Approach as well as outcome of the 2003 HELCOM Ministerial Meeting with Baltic Sea specific dimensions and follow-up (V).

In the section "applying the ecosystem approach in the HELCOM and OSPAR frameworks" (§§11-29) of the 2003 joint statement (JMM, 2003a) the coastal countries and the EU outlined the implementation of the ecosystem approach to consist of the following[27] (grouping and rephrasing applied):

- cooperation with stakeholders and other management authorities (§15a, §16)[28]
- monitoring of ecosystems (§15b & §§17-20)
- setting objectives for environmental quality (§15c & §§21-22)
- assessment of ecosystems (esp. integrated assessments and indicators) (§15d & §§17-20)
- managing human activities (§§24-26)
- periodic review (§§28-29)

Comparing this definition with the follow-up (I-V) it can be concluded that HELCOM has implemented the ecosystem approach. This work has included cooperation with stakeholders (I, II) as well as other management authorities in the fields of MSP (III), shipping (IV) but also fisheries (V) (HELCOM, 2016) and agriculture (V). Ecological objectives for environmental quality have been agreed and used (I). The regional monitoring and assessment work have been revised and have enabled indicators and integrated assessments (I, V) (HELCOM, 2019). Tailored action plans have been drafted, agreed upon, and reviewed (II, V).

Due to this, the remaining thesis will focus on how this implementation has been carried out and what its special features have been. In this the conceptual framework developed in the Chapter 2 will be used to summarise results as well as the following discussion. According to the framework the implementation of the ecosystem approach within HELCOM can be considered to consist of the elements of quantification, integration, and measures.

[27] With the addition of separate point on conservation, the same points are highlighted in the 2003 JMM ministerial outcome (JMM, 2003b) as priorities of future work for HELCOM and OSPAR.

[28] titled "understanding and acceptance" in §15a

On an overall level the 2003 joint ministerial declaration (JMM, 2003b) and the ecosystem approach statement (JMM, 2003a) highlight the ecosystem approach as a promotion of policy integration and cooperation across various boundaries, referred to as the theme of *integration* in Figure 2. The documents recall commitments to implement the ecosystem approach made within CBD and the 2002 WSSD (2002) at a global level. A key theme of the entire meeting was the commitment of the two organizations to participate in the development of the European Marine Strategy with aims to integrate policies related to the marine environment across Europe (EC, 2002). This strategy resulted later in the adoption of the EU MSFD (EU, 2008). In the introductory[29] section the joint declaration commits the contracting parties to the new ecosystem approach which "matches the interlinkages within ecosystems" and especially "ensures that policies interface effectively with each other" as the pressures created by other policies must be addressed within those contexts. In addition to the EU marine strategy the documents refer to important synergies with the EU Birds and Habitats Directives, the Water Framework Directive (WFD), the Urban Wastewater Directive, the Nitrates Directive as well as the Common Agricultural Policy (CAP) and the Common Fisheries Policy (CFP). The involvement of stakeholders is also emphasised. Even the nature of the event itself, as a joint undertaking between two organizations, is a point in this direction.

The three documents also highlight the ecosystem approach as setting objectives for environmental quality as well as monitoring and assessing of ecosystems, issues which are referred to as *quantification* in the conceptual framework of Figure 2. HELCOM made a commitment to develop ecological quality objectives through a pilot project (JMM, 2003a), for eutrophication expressing "good quality status" as in the WFD, but covering the whole Baltic Sea (HELCOM, 2003a). The HELCOM Declaration also highlights the need to review regional monitoring and assessment work for more timely and complete information as well as better synergies with other requirements such as WFD.

The original 2003 declarations also point at the ecosystem approach as achieving management of human activities through *measures,* which is the remaining third main element of Figure 2. A key substantial outcome of the JMM was a commitment to develop a full set of management measures consistent with the ecosystem approach by 2010. The HELCOM declaration recognises particularly that, despite substantial efforts to reduce nutrient pollution, eutrophication remained a problem and points at a need for further measures to reduce nutrient loads from agriculture (waterborne), emissions to air as well as wastewater. These measures were recognised to involve decisions in other management authorities and contexts, including the CFP and CAP.

[29] Preambular paragraph 4

References to the ecosystem approach (or ecosystem-based approach) are also found in the outcomes of other four HELCOM ministerial-level meetings organised 2003-2018 which followed progress in implementing the BSAP (V) but also agreed on new management *measures*. Taken together the concept has been explicitly invoked in the connection of five main topics reflecting the elements of *integration* and *quantification* in Figure 2: the need to develop ecosystem quality objectives and indicators as well as related monitoring and assessment products, the importance of developing economic tools to demonstrate cost-effectiveness of measures, issues requiring cross-sectoral cooperation and measures (especially fisheries but also other fields), marine spatial planning and regional implementation of the EU Marine Strategy Framework Directive (MSFD) (V).

In parallel to the 2003-2018 implementation of the ecosystem approach, the total quantity of HELCOM work, measured as person hours in meetings (excluding preparatory work), nearly doubled (from 9985 person hours to 18365 person hours annually) (V) (Figure 7, Figure 8). The number of individual HELCOM meetings, as defined in Article V, increased similarly from 25 in 2003 to 66 in 2018.

This increase can be attributed to a uniform increase in meetings and their participation in traditional HELCOM work, but also to the emergence of entirely new fields of HELCOM activity (V). A central new development has been the introduction of new HELCOM groups on the topics of Fisheries, Marine Spatial Planning and Agriculture as follow-up to the 2007 BSAP and its aims of policy integration. A substantial, even if fluctuating, increase in the relative share of meeting hours since the BSAP can also be observed in the topic of technical work on land-based pollution loads, which includes work to assess progress toward the maximum allowable input (MAI) and country allocated load reductions (CART), as well as revision of the initial 2007 MAI&CART for the 2013 Ministerial Meeting in Copenhagen. The HELCOM GEAR group, with tasks on coordinating MSFD implementation in the Baltic Sea, established in 2012, is also a new group 2012-2018 (V).

The other fields, experiencing an increase in person hours in meetings but retaining a relatively stable share of the total HELCOM work, include monitoring and assessment of the state of the Baltic Sea environment, consistently the single field of HELCOM activity with the largest average number of person meeting hours (V). This field of activity constituted on average 28,4±4,0% of the total annual HELCOM work 2003-2018. The other more traditional fields include land-based pollution/pressures, maritime transportation, response to spills and biodiversity. These four issues together constituted on average 36,6±2,9% of overall HELCOM work 2003-2018 with equal shares. The number of person hours within the HELCOM decision making bodies, the Heads of Delegation (HOD) and the annual Helsinki Commission meeting has not increased during the period, and the relative share of these groups has consequently more than halved from 31,7% in 2003 to 11,0% in 2018 (V).

5.2 EA AS QUANTIFICATION (ARTICLE I, II & V)

Some months after the 2003 ministerial meetings the implementation of the ecosystem approach within HELCOM was focused on the development of "ecological quality objectives" and related indicators within the organization (HELCOM, 2003b). Three years later a set of *ecological objectives* were adopted by HELCOM in 2006 (HELCOM, 2006a) (Figure 5). These ecological objectives are a set of desirable or "good" (Mee et al., 2008) characteristics of the Baltic Sea ecosystem under three of the four strategic goals of the organization in the fields of eutrophication, hazardous substances, and biodiversity (I). A fourth strategic goal, and one corresponding set of *management objectives,* concerned maritime activities in the Baltic Sea (I). The adopted objectives represent a consensus emerging from a series of HELCOM meetings and events 2003-2006 involving both scientific and management experts, based on early work by Valanko (2003) as well as drafting and facilitation by authors (I).

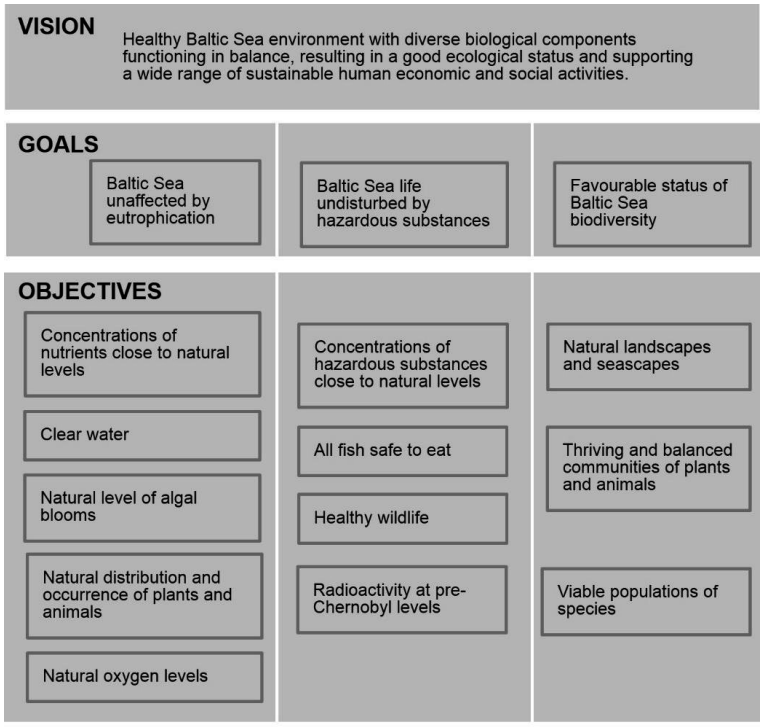

Figure 5 General outline for the HELCOM system of ecological objectives (I).

In addition to the conceptual approaches of OSPAR (Heslenfeld and Enserink, 2008) provided via the context of the joint ministerial meeting, the HELCOM ecological objectives were based on the ecosystem approach

implementation frame and terminology described in an ICES report by Rice et al. (2005) (I). (cf. Table 2).

In more practical terms this development of the ecosystem objectives was an important part of the renewal of HELCOM monitoring and assessment work, which was carried out in parallel (I). The objectives highlighted themes to be considered in the development of indicators with quantitative target levels and ensuring the needed environmental monitoring (I). The stepwise nature of the work (Figure 6, cf. Table 2) also had a strategic aim as the verbal goals and objectives (Figure 5) were assumed to pave the way for the adoption of numerical targets of indicators which are likely perceived as more politically sensitive (II at 644) (Backer, 2008).

The new monitoring and assessment strategy, based on the regularly updated indicators (HELCOM, 2006a, 2003b), was considered necessary to make better use of the coordinated HELCOM monitoring data compared to the traditional periodic assessments, published infrequently and in a bulky format (I). Besides timelier, this new type of more concise assessment products were intended to facilitate the communication of ecosystem properties to decision makers (I). In addition to the use within the region, the ecological objectives and indicators developed based on them were aiming at facilitating the use of HELCOM monitoring and assessment products in other frameworks (I). This included considering interlinkages with global (CBD) and European (Habitats Directive, Water Framework Directive and Marine Strategy Framework Directive) assessment processes (I). Later, such efforts to maximise the use of HELCOM products at other fora was extended to other processes, such as reporting of regional progress toward Sustainable Development Goals (SDGs) related to the marine environment, especially SDG 14 (life under water) (HELCOM, 2017a, 2017b).

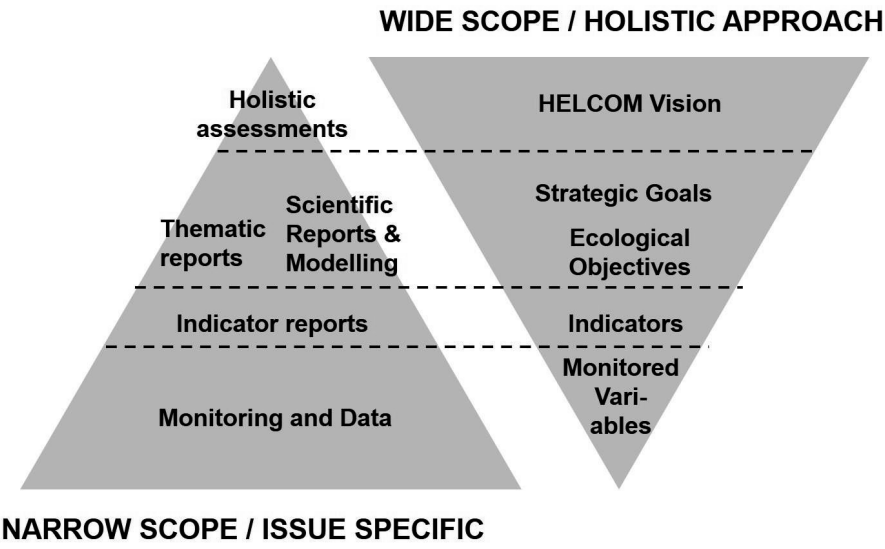

Figure 6 Schematic figure on stepwise work to define good status of the Baltic Sea marine environment and assessment work (HELCOM, 2005) (I).

The ecological objectives and indicators were also recognised not as an end in themselves but as a preparatory step to develop management measures (I). Article II outlines this link by describing the HELCOM process to implement ecosystem approach 2003-2008 as four phases: an initial preparatory phase 2003-2004 defining aspirational objectives, a quantitative phase defining operational targets based on the objectives and a dedicated plan of actions (2005-2007) and implementation of actions 2008-.

Accordingly, the four strategic goals (on Eutrophication, Hazardous substances, Biodiversity and Maritime activities) and the objectives were also used in the development and outcome of the 2007 HELCOM BSAP (II), which can be seen in the outline for the first part of the BSAP document, containing measures to reach good status of the Baltic Sea (HELCOM, 2007).[30] In the case of eutrophication, the link was clearest between the ecological objectives, indicators and the required level of reductions in nutrient pollution and thus eventually measures. The ecological objective "clear water", its indicator (annual average secchi depth) and basin wise target levels were also used as the starting point in modelling efforts (Savchuk et al., 2008; Wulff, 2007) which defined the Maximum Allowable Input (MAI) and Country-Allocated Reduction Targets (CARTs) of the 2007 HELCOM BSAP (II). These MAIs and CARTs were revised for the 2013 ministerial meeting to reflect a larger suite of

[30] The remaining sections (Development of assessment tools and methodologies, Awareness raising and capacity building, Financing, Implementation, and review) provided tools to ensure that the measures were carried out.

indicators[31] but their function and even the order of magnitude of the necessary emission reductions remained the same (HELCOM, 2013a). This approach, comparable to the critical loads approach used in the UNECE Convention on Long-Range Transboundary Air Pollution (CLRTAP) cooperation (Cresser, 2000; Sliggers and Kakebeeke, 2004), was at the time a relatively novel regulatory tool in the international environmental policy on the marine environment (II).

5.3 EA AS INTEGRATION (ARTICLE I, II, III, IV & V)

The theme of policy integration in the implementation of the ecosystem approach within HELCOM can be explored by the three dimensions of HELCOM cross-sectoral cooperation, highlighted in Article IV in the context of IMO related work. These three dimensions are cooperation between different strands (sectors) of national administration, between different geographic scales of governance (national-regional-EU-global) and between public administration, the private sector as well as NGOs (IV).

A characteristic of BSAP (II) as well as HELCOM ecosystem approach implementation 2003-2018 in general (V) has been an expansion of work in fields which have been at the fringes or even outside the traditional fields of organizational competence. This includes particularly accelerated[32] cooperation on environmental aspects of fisheries and agriculture (V) but since 2010 also the creation of an entirely new field of regular cooperation within HELCOM, on Maritime or Marine Spatial Planning (MSP) (III, V) (Figure 7) This development stimulated the participation of new organizations and professional groups to the work of HELCOM.

[31] Secchi depth (summer), winter nutrient concentrations of DIP, winter nutrient concentrations of DIN, Chl α (summer) & oxygen debt/concentration (HELCOM, 2013a).

[32] cf. Schnug et al. (2001), providing a snapshot of early HELCOM work on agriculture.

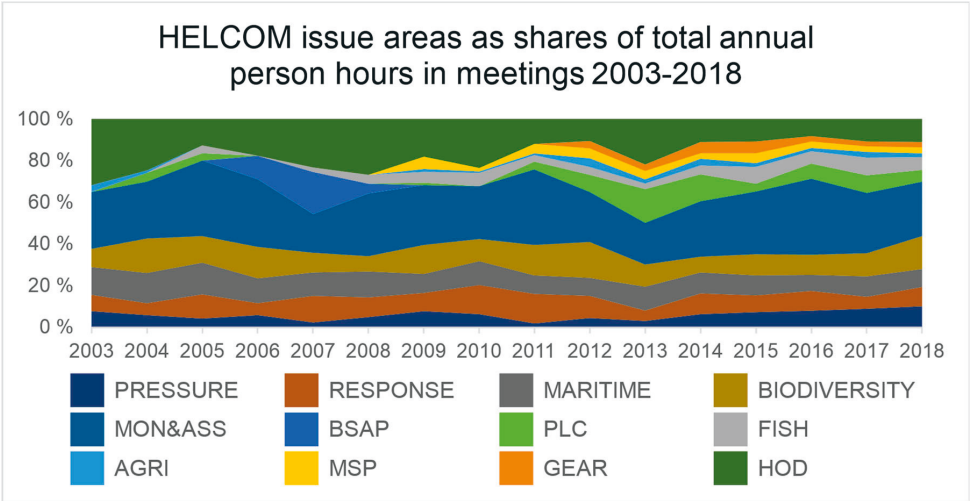

Figure 7 HELCOM issue areas as shares of total annual person hours in meetings 2003-2018. Based on a classification of 724 HELCOM meetings 2003-2018 (Article V).

The emergence of MSP as a regular field of HELCOM work (III) (Backer, 2015) is an example of the new types of cooperation. Even if the field of MSP already has a history (Jay, 2019) it emerged to the wider recognition fairly recently, after the turn of the millennium. It was inspired in form by planning on land (Hall, 2002) but emerged mainly from the marine management context with a distinct emphasis on the ecosystem approach, a scientific basis and conservation imperatives (Douvere, 2008; Jay, 2010, pp. 180–181), characteristics which also made it fit well into the HELCOM ecosystem approach implementation process. Another contributing factor was the legacy of spatial work on Marine Protected Areas and integrated coastal zone management carried out within HELCOM since the 1990s (III).

Formal HELCOM work on MSP was initiated at the 2003 ministerial meeting (III). The joint statement on the ecosystem approach (JMM, 2003a), promoted the development of spatial planning tools in marine areas (III). For HELCOM this commitment was strengthened by the adoption of a targeted recommendation on "Integrated Marine and Coastal Management of Human Activities in the Baltic Sea area" (HELCOM, 2003c).[33] The 2007 BSAP highlighted the issue with the adoption of the HELCOM Recommendation on Broad-scale MSP principles (III, p.284). The first draft of the principles was co-generated at a regional workshop with a dedicated project providing subsequent drafting support. [34] In 2010, the two regional organisations

[33] This reference is not included in Article III.

[34] HELCOM MSP WS 27-29 Jan 2009, organised by the HELCOM SCALE project (2008-2009, implemented by the author) in cooperation with Finnish Ministy of the Environment.

working with MSP, HELCOM and VASAB, fulfilled the recommendation by adopting the Baltic Sea broad-scale MSP principles, including a general principle 2 on the ecosystem approach,[35] and also established a joint intergovernmental working group (III). Regional projects such as the Plan Bothnia transboundary MSP pilot project (2010-2012) (Backer and Frias, 2012) provided the new cooperation with substantial input to discussions on the planning implications of the ecosystem approach and other similar topics (III).

From the start the HELCOM ecosystem approach implementation was also closely linked to EU level work, particularly preparing, and implementing the EU Marine Strategy Framework Directive (MSFD) in the Baltic Sea region (I, II). A key element of the HELCOM ecosystem approach implementation of the 2003 JMM was a commitment to work with and support the EU marine strategy process. Later, this close link between BSAP and the MSFD was also explicitly highlighted in a letter submitted by HELCOM to the EU commission in April 2009 (II). An illustration of the close links between ecosystem approach implementation and MSFD implementation in the HELCOM context is given by the name of the group established in 2012 to fulfil the obligation to cooperate regionally (Article 6 of EU, 2008): Group for the Implementation of the Ecosystem Approach (GEAR). The HELCOM implementation the ecosystem approach has also highlighted the need for synergies with other EU work, such as the Birds and Habitats Directives, the Water Framework Directive, the Urban Wastewater Directive, the Nitrates Directive, the Marine Spatial Planning Framework Directive, the Common Agricultural Policy (CAP) and the Common Fisheries Policy (CFP) (I, II, V). The quantification of the status of the Baltic Sea, as described in the previous section, has also been at least partly an application of concepts from the EU environmental management, particularly the WFD, to the protection of the Baltic Sea and the work of HELCOM (I). This resulted in work to explore synergies with the implementation of the EU Water Framework Directive, including especially the work to define the good status of the Baltic Sea coastal waters (II).

As a joint commitment between HELCOM and OSPAR, the ecosystem approach implementation was also an example of cooperation between regional initiatives (V), which continued with concrete work in fields such as reducing the introductions of non-native marine species via ships ballast water

[35] *"2. Ecosystem approach* The ecosystem approach, calling for a cross-sectoral and sustainable management of human activities, is an overarching principle for Maritime Spatial Planning which aims at achieving a Baltic Sea ecosystem in good status -a healthy, productive and resilient condition so that it can provide the services humans want and need. The entire regional Baltic Sea ecosystem as well as sub-regional systems and all human activities taking place within it should be considered in this context. Maritime Spatial Planning must seek to protect and enhance the marine environment and thus should contribute to achieving Good Environmental Status according to the EU Marine Strategy Framework Directive and HELCOM Baltic Sea Action Plan." (HELCOM and VASAB, 2010)

(IV). The HELCOM work on maritime transportation is also an example of close interaction between the Baltic Sea regional initiatives and global decision making (IV).

The involvement of stakeholders, in other words representatives of non-governmental organizations (members of the civil society, representatives of industry) as well as other international organizations, is an important element of the ecosystem approach at HELCOM (JMM, 2003a), and elsewhere (see 2.2.). Even if the involvement of stakeholders was not studied in depth as part of this thesis, new organizations active in the expanding fields of fisheries, agriculture and spatial planning (V) but also in the more traditional fields such as maritime transportation (IV) were engaged during the HELCOM implementation of the ecosystem approach. However, attracting relevant stakeholders to regular regional cooperation has been observed to be challenging (IV). Stakeholders are likely to participate if initiatives on concrete measures, such as proposals to amend IMO treaties, are discussed (IV, p. 261). Inversely, deliberations on essentially abstract concepts such as a good status of ecosystems (or the ecosystem approach itself) may not be interesting enough to justify the time investment (IV).

5.4 EA AS MEASURES (ARTICLE II, IV & V)

The Baltic Sea Action Plan (BSAP) (HELCOM, 2007) was adopted to fulfil the commitment to develop a full set of management measures necessary to implement an ecosystem approach, made at the 2003 Bremen ministerial meetings (II) as well as the 2002 UN WSSD in Johannesburg (WSSD, 2002). The main content of the bulky BSAP document, 102 pages with attachments, is a large set of decisions and management measures (II) aiming to reach the HELCOM ecological objectives (I). The measures are grouped under the four goals of HELCOM (on eutrophication, hazardous substances, biodiversity and maritime activities) (II) as well as tools to ensure that the measures would be carried out (development of assessment tools and methodologies, awareness raising and capacity building, financing, implementation, and review). The substance of the BSAP measures particularly includes three key features: the quantitative nutrient pollution reduction targets based on ecosystem quality, a strong thematic expansion to the fields of fisheries, agriculture and maritime spatial planning[36] as well as a strong link to the parallel EU work on the Marine Strategy (II).

The eutrophication part of the BSAP contains measures related to nutrient loads from diffuse sources such as agriculture, but also from transportation (such as sewage and NOx emissions from ships) (II), which had been identified as a justification and rationale for the ecosystem approach (II) (HELCOM,

[36] In addition, the document included important substance also to specific, and controversial, issues such as management of seal populations.

2003a). For eutrophication, the stepwise implementation of the ecosystem approach according to the model provided by Rice et al (2005) was considered as especially complete (II). The BSAP definitions of good status, in terms of quantitative indicator (secchi depth) targets for the ecological objective on "clear water" derived from monitoring, and needed nutrient input reductions to reach it, as basin and country-wise nutrient input ceilings derived from modelling, was highlighted as an innovative approach in the international environmental policy on the marine environment (II).

The fact that many of the key decisions on measures to reach the BSAP objectives would have to be taken within other contexts, less focused on the environment, was early on recognised as a potential implementation challenge for the BSAP and the MSFD (II). The EU Common Agricultural Policy (CAP) and Common Fisheries Policy (CFP) were considered as especially challenging fields for this kind of delegation (II). As a start the BSAP included commitments to submit joint HELCOM input to the revision of the EU Common Fisheries Policy (CFP) (HELCOM, 2009) and the EU Common Agricultural Policy (CAP) health check (HELCOM, 2008) (II).

The BSAP included decisions for proposing and implementing global IMO measures in the Baltic Sea- specifically on MARPOL special area regulations on air pollution (Annex VI, on Sox and NOx), sewage from passenger ships (Annex IV) as well as regional procedures to implement the Ballast Water Management Convention (II, IV). The long HELCOM legacy of work toward the global regulator International Maritime Organization (IMO) to reduce environmental effects of maritime traffic (IV), paved way for later success with IMO decisions on all these substantial proposals included in the BSAP (IV). As such regional IMO measures involve strong industry interests, they typically require a decade from the launch of HELCOM preparations to the final IMO decision (IV). During this period, they need continuous support from committed coastal states and stakeholders to become a reality (IV). The 2007 BSAP nutrient reduction targets provided the underlying rationale for the NECA and Sewage Special area processes aiming at more stringent reductions in nutrient inputs compared to other sea areas of the world (IV).

In terms of organizational output, fewer technical measures have been agreed upon during the recent years compared to the period before 2010 even if the amount of work, measured as person hours in meetings,[37] has doubled (V) (Figure 8). It could be claimed that the point of gravity of organizational output has shifted away from concrete management measures toward scientific assessments (V).

[37] person hours in a meeting = number of participating persons × recorded meeting duration (hours)

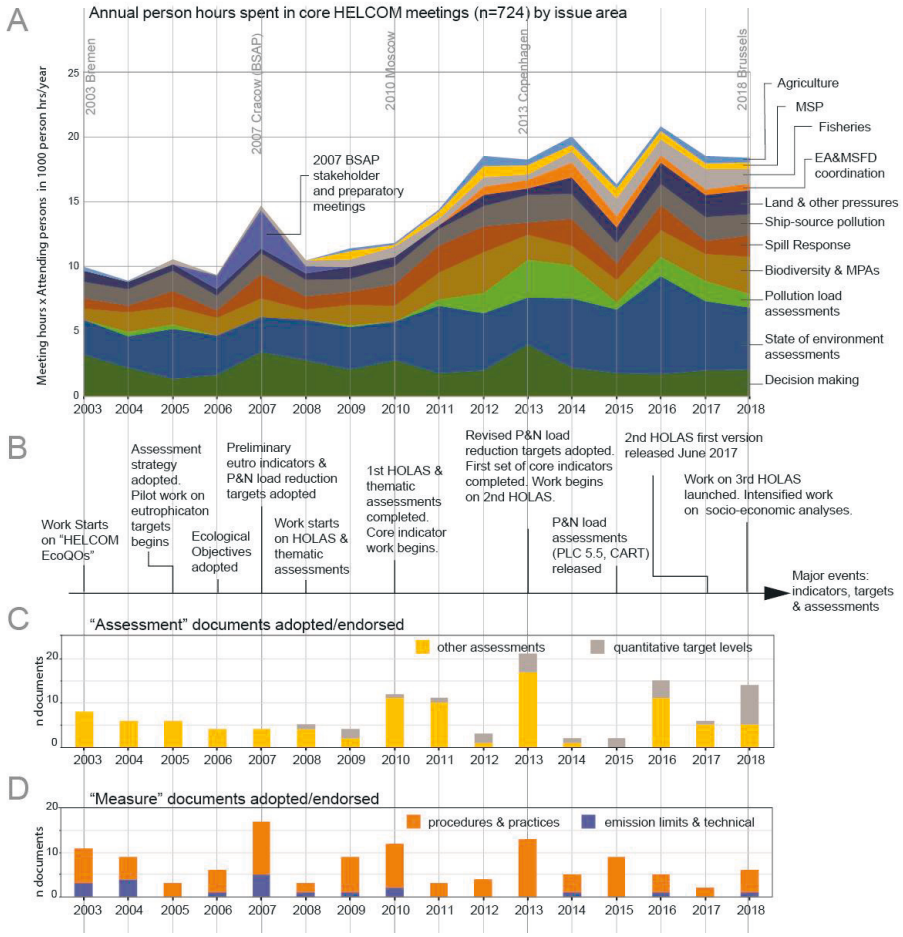

Figure 8 Evolution of HELCOM work 2003-2018 in terms of person hours spent in 724 HELCOM meetings 2003-2018 (A), a selection of key events related to definitions of ecological quality/good status and related assessments (B), adoptions of assessment type documents/reports/publications (C) as well as adoptions of management measure type documents (D). See Article V for methodology.

6 DISCUSSION

6.1 OVERALL

This thesis has provided general observations related to the HELCOM implementation of the ecosystem approach. One is the quantified doubling in the volume of the HELCOM cooperation overall with clear relative increases in the cross-sectoral fields of MSP, fisheries and agriculture and regional coordination of the MSFD (V). The other is the relative decrease in the adoptions of technical measures (V).
Even if one could consider that the decrease in agreed measures is a natural evolution for topics which have been on the agenda for a longer time, as implementation of existing measures should take precedence over drafting new measures, several new fields of cooperation have been introduced to the agenda for which few if no concrete HELCOM measures exist.

The underlying connection to the ecosystem approach as such is more difficult to establish. Even if the described changes in HELCOM work 2003-2018 coincides with the implementation of the ecosystem approach, also other processes also took place in parallel. One is the EU regional work to implement the MSFD, agreed in 2008, which includes the role of HELCOM as a regional coordination body. The other is the general increase in regional cooperation, possibly stimulated by the 2005 EU expansion in the region, as well as the EU Strategy for the Baltic Sea Region (EUSBSR), other related legislative initiatives such as the implementation of the EU MSPFD as well as the general surge of regional project funding (e.g. BONUS, INTERREG and even the GEF-funded Baltic Sea LME project 2003-2007). In particular, it is not possible to separate between the implementation of the MSFD and that of the ecosystem approach within HELCOM based on the collected material alone.

The findings might contrast with earlier findings (Hassler et al., 2013; Hegland et al., 2015; Söderström, 2017; Valman, 2014) that the implementation of the ecosystem approach has not resulted to any deeper institutional changes within HELCOM. The results (V) confirm the qualitative observation by Valman that a thematic expansion of HELCOM work has taken place without subsequent cuts in old issues, observed by Valman as 'layering' (Valman, 2014, p. 43).

In any case, the clearer link to EU (MSFD) work has likely made HELCOM perceived as more important, as an arena where interests need to be defended, with increasing participation as a result. The level and width of expertise needed to operationalize the science-based ecosystem assessment system (I) has also likely increased the number of persons involved in HELCOM work.

6.2 QUANTIFICATION

As highlighted above, despite the relatively[38] wide definition of the ecosystem approach adopted at the 2003 Joint Ministerial Meeting (JMM, 2003a), its short-term practical implication for HELCOM work was from the start focused on the definition of good ecological status, or the "quantification" element of the conceptual framework proposed in Figure 2. To the HELCOM work on the marine environment of the Baltic Sea, this element of the ecosystem approach can be considered to come from EU regulative processes (Boeve and Van den Broek, 2012; EC, 2002) but also, via OSPAR and ICES documents (Rice et al., 2005), from international cooperation within the North Sea area, including the Wadden Sea cooperation (de Jong, 1992), OSPAR (Heslenfeld and Enserink, 2008), and the North Sea conferences (de Jong, 1992; Misund and Skjoldal, 2005), and national work (de Jong, 1992). Further back it was, at least partly, also derived from earlier work on ecosystem modelling and management in the region and beyond (Jansson, 1972; Mayda, 1973), including initiatives such as Great Lakes Cooperation (anon., 1978; GLRAB, 1978). These approaches predate the CBD definitions of the ecosystem approach and are not directly derivable from it.

The importance of such quantitative definitions in ecosystem approach implementation efforts at least in European regional seas contexts has been somewhat neglected in scholarly studies of the ecosystem approach. The work on such definitions have constituted a major share of the HELCOM implementation efforts. Further, the definitions themselves give a concrete and measurable form to "ecosystem integrity" elements of the ecosystem approach, which have been recognised but considered unclear by at least some commentators from the field of law (Platjouw, 2016)

The development of a comprehensive set of indicators, related target levels and monitored variables, as foreseen by the HELCOM monitoring and assessment strategy of 2005, has been a significant investment by the coastal countries and HELCOM at large (V). Even if it was from the start recognised as a much more challenging task than the first phase of ecological objectives (I) it is unclear whether the total level of effort needed was foreseen when the concept was launched. It has required nearly 15 years and considerable efforts to complete the full regional assessment system for the state of the Baltic Sea. The step from the verbal objectives (I) to defining and agreeing on scientifically justified indicator parameters and their target levels was first tested for eutrophication published in 2006 (HELCOM, 2006b), the first proper set of HELCOM indicators with targets was released in 2013 (HELCOM, 2013b) and finally it took another six years before the first HELCOM holistic assessment fully using these indicators and targets was

[38] Perhaps due to his town planning background Jay (2010, p. 181) interestingly reads the 2003 HELCOM/OSPAR definition of the ecosystem approach as an explicit assertion of the primacy of scientific knowledge in management.

published (HELCOM, 2019). Using the framework created by Varjopuro et al (2014), there has thus been a significant *implementation delay* of the HELCOM quality-based, ecosystem assessment framework for the state of the Baltic Sea marine environment, even with a high level of interest from the coastal countries and the EU Commission resulting in access to resources.

Such quantitative definitions of good status were at least indirectly justified by hopes of creating a new, more rational (Edvardsson Björnberg, 2008), form of law and management for the Baltic Sea marine environment (I). However, the practical function of such science-derived concepts in environmental management and law involves open questions (Boeve and Van den Broek, 2012). Combined with the statistical complexities involved and the full reliance on national implementation, the quality objectives approach of HELCOM and also MSFD might actually risk a low level of ambition in actual measures (Ringbom and Joas, 2018). Further, as authors like Langlet and Rayfuse (2018a) and Ringbom and Joas (2018) have pointed out that such quality targets would be difficult to use in a confrontational setting such as legal proceedings. While it is true that similar WFD quality standards have resulted in a substantially hard decision in the 'Weser' judgement (ECJ, 2015), the higher level of geographical abstraction and statistical uncertainties inherent in MSFD and HELCOM ecological quality targets make similar outcomes unlikely (Langlet and Rayfuse, 2018a).

Systemic delays are also limiting the utility of targets on the state of the ecosystem in management of the Baltic Sea marine environment. Basin -wide state variables are challenging to measure reliably and respond very slowly to management. As an example, the full effects of progressive management efforts in the field of nutrient pollution control would be visible only after a century (Murray, 2019), due to ecosystem delays (Varjopuro et al., 2014). Information on human activities or drivers of change would also be needed for the ecosystem approach (Elliott et al., 2017). Indicators based on such information would be easier to link to concrete management measures (Rapport and Hildén, 2013). They could also enable drafting and agreement on *management objectives* – like those agreed in 2006 (HELCOM, 2006a) for maritime issues (I, II).

Even if there have been increasing efforts (V) (HELCOM, 2019, 2018b) to use ecosystem services and cost-benefit analyses of measures, they do not automatically give better tools to assess and expediate the implementation of actual measures. Systemic delays and the need to follow up and assess measures and human activities more explicitly have been considered in the ongoing process to update the BSAP (HELCOM, 2020a). Even if the details are yet to emerge, such new focus could catalyse HELCOM follow up, and even national implementation, of concrete priority measures.

However, regardless of their clear legal function or management utility, these definitions can be considered to have a pedagogical value. Their development has provided for a mutual learning process involving scientists and policymakers on how the Baltic Sea ecosystem works and what needs to

be done (Bohman, 2018; Johnson, 2008), which was also one of the core original aims (I) (JMM, 2003a).

The definitions of ecological quality may also be influential in other, soft ways. Bohman highlights that such definitions enable a special form of managerial compliance with HELCOM decisions (Bohman, 2018). The definitions could also be considered to function as softer 'science- based ethical imperatives' (Tarlock, 2012), limiting at least indirectly the degree of freedom the coastal states and the EU have in the implementation of the 1992 Helsinki Convention. An example of the practical use of such good status definitions could be the references made to the BSAP nutrient reduction targets in the justifications of applications and other submissions to IMO on MARPOL Sewage and Special Areas in the Baltic Sea (IV). This is perhaps similar to the function of the 2-degree limit for global warming agreed within the UNFCCC framework (Morseletto et al., 2017).

In summary, it can be concluded that the HELCOM implementation of the ecosystem approach has involved a significant component of quantification (Figure 2) in the form of work to define a good status of the Baltic Sea ecosystem.

6.3 INTEGRATION

In the marine management context, the popularity of the ecosystem approach concept is related to the relatively widespread agreement on the need for more integrated management of the world's oceans and seas. These calls are based on the failures of traditional marine management, with separate sectoral "silos" for issues such as environment, fisheries, transport and offshore energy, on the need to harmonise between work taking place at national, regional, EU and international (e.g. UN) levels but also on the general need to open up dialogues and reach a common agreement sustainable level of exploitation/development. This kind of integration (Figure 2) has also been an important part of HELCOM implementation of the ecosystem approach.

The importance of the European dimension of the HELCOM ecosystem approach and BSAP (I, II) has been highlighted by several authors (Bohman, 2018; Gilek et al., 2016; Hassler et al., 2013; Hegland et al., 2015; Ringbom and Joas, 2018; Söderström, 2017). The publications I (2008) and II (2010) of this thesis emphasize the same. This is not surprising as it is clear from the 2003 ministerial declarations (JMM, 2003b) and latest at the BSAP (II) that the implementation of the ecosystem approach at HELCOM has been closely linked to the development of the EU Marine Strategy (EC, 2002) and the EU MSFD (EU, 2008). The fact that eight of nine coastal countries have been members of the EU since the May 2004[39] has naturally been an important

[39] EU accession of Estonia, Latvia, Lithuania and Poland

contributing factor. The BSAP preparations and outcome completed in 2007 included a nearly identical set of steps as required by the MSFD Directive (II).

In retrospect, the HELCOM processes for the implementation of MSFD and ecosystem approach processes are today (2020), and likely have been from the very beginning, so intertwined that it is somewhat artificial to discuss them as separate phenomena. As described (I, II) HELCOM and the other European regional seas conventions were closely involved in the EU Marine Strategy process (EC, 2002; JMM, 2003b) and were also given an explicit role in the implementation of the EU MSFD (EU, 2008). Also more generally there is a striking similarity between the ecosystem approach and the key elements of the EU programmatic approach to environmental regulation (Boeve and Van den Broek, 2012), namely the definition of environmental quality standards and the use of flexible programmes of measures for actual implementation, with procedures for coordination across different policy areas. In a very similar vein, Ringbom and Joas (2018) have highlighted the general increase of process-oriented rules (Ringbom and Joas, 2018) in the Baltic Sea region.

The link between the implementation of the ecosystem approach at HELCOM and European policy developments also extended beyond the evident MSFD work. Implementation synergies have been explored with work on Birds and Habitats Directives (I) as well as Water Framework Directive, Urban Wastewater and National Emission Ceiling Directives (II). The BSAP influenced also the marine environment -related contents of the EU Strategy for the Baltic Sea region (EC, 2009) and also resulted in the submissions of joint HELCOM input to the revision of the EU Common Fisheries Policy (CFP) (HELCOM, 2009) and the EU Common Agricultural Policy (CAP) health check (HELCOM, 2008).[40] As highlighted (II), the success of the BSAP relies extensively on decisions by such frameworks outside the direct influence of HELCOM. Finally, the regional work on Maritime Spatial Planning (MSP) in which HELCOM became engaged as part of the ecosystem approach implementation (III) was greatly catalysed by the preparations and adoption of the EU Marine Spatial Planning Directive (EU, 2014) (III).

In addition to the growing importance of such EU dimensions, the ecosystem approach implementation within HELCOM has also significantly (V) expanded the cooperation and policy integration in fields of Maritime Spatial Planning (MSP), Fisheries and Agriculture. Similar to the new groups on fisheries and agriculture established as a follow-up of the BSAP (V), as well as the HELCOM group on environmental issues related to maritime transportation (IV), the joint group on MSP provides a meeting point for two different professional groups, in this case experts in spatial planning on land and those with backgrounds in marine environment (III) which need time to find a common language and trust (UN Environment, 2017). At least in the beginning, these new forms of cooperation have brought to the surface

[40] The final HELCOM inputs on CFP and CAP revision were perhaps somewhat roundish in substance, but nevertheless a significant achievement from a symbolic perspective.

different interpretations of constructively ambiguous (Klabbers, 2013) concepts such as ecosystem approach or sustainability (III).

In these new forms of cooperation, HELCOM has been engaged in lengthy dialogues with partners which did not automatically accept that human activities at sea should be balanced and considered within a framework of HELCOM ecological objectives, indicators and assessments of good status of the Baltic Sea (III, II) (Backer, 2015). One example is the fact that Sustainable Management is the first of the joint Broad-Scale MSP principles while the Ecosystem Approach is listed as the second (III). Another example of the dialogues involved (Gilek et al., 2019; Piwowarczyk et al., 2019) is the joint guideline on ecosystem approach in MSP (HELCOM and VASAB, 2016, pp. 12–18), which took four years of negotiations to agree upon within the joint MSP WG. Qiu and Jones see this kind of debates as reflecting the challenging reconciliation between 'hard' sustainability, a belief that a collapse of ecosystems would mean collapse of societies, and 'soft' sustainability, a belief that societies would survive the collapse of ecosystems (Qiu and Jones, 2013). A similar dynamic, via the latent tension between *ecosystem* (science/environment/nature) and *management* (of human activities/needs of society), or the classical dualism of *anthropocentric* and *ecocentric* viewpoints or justifications (Boylan, 2013) is also a source for the substantial interpretations and definitions of the ecosystem approach concept itself (De Lucia, 2019).

In their analysis of the relationship between the ecosystem approach and MSP in the Baltic Sea, Gilek at al. (2019) see indications that the definition of the ecosystem approach in the Baltic Sea MSP work is still more characterised by its conception as an ecological quality-based regulation and MSFD ('hard' sustainability) and less as the 'soft' sustainability of the integrative deliberation definition of the ecosystem approach, sensu CBD.[41] Using this terminology the science-driven quantitative element of ecosystem approach implementation within HELCOM might be considered as "hard" sustainability, at least when applied to the MSP context.

The willingness and skills to create constructive solutions and middle ground in such an issue is of importance also in more classical implementation challenges in Baltic Sea marine management, where decisions on the marine environment are taken in contexts which are more focused on human needs. The latter includes the EU Common Agricultural Policy (CAP), Common Fisheries Policy (CFP) and EU Maritime Policy (I, II, III), policy areas and contexts to which the new HELCOM groups on agriculture, fisheries and MSP are connected.

Like planning in general, MSP is also ultimately about time, specifically about the future, and steering spatial developments in a desired direction with the help of visions and scenarios (Maes et al., 2005, p. 118). If applied also to

[41] However, in practical applications (e.g. Backer and Frias, 2012, p. 119) such general principles may be easily fulfilled regardless of selected interpretation.

other fields this forward-looking element of MSP practice could reinforce the HELCOM efforts to implement the ecosystem approach. This future element is currently underutilised, even if inherent in ecosystem models as well as the concept of ecological objectives and other targets describing a desired future in verbal or numerical form (Paper I, Figure 5).

In conclusion, the HELCOM work to implement the ecosystem approach has included a significant element of policy integration, both in terms of regionalizing of EU policies but also as an expansion of HELCOM activities in fields which offer challenging cross-sectoral cooperation. These have provided valuable opportunities for reflection and learning on the possible function of the HELCOM ecosystem approach implementation, and definitions of good status of the Baltic Sea, outside the field of marine environmental protection. A systematic exploration of the possible ways of cooperation and consensus building could be helpful to reach faster agreement in this kind of cross-sectoral work.

6.4 MEASURES

As Sander (2018) highlights, diverging opinions in the implementation of the ecosystem approach arise especially when moving from the domain of scientific reports and abstract plans to measures, or from diagnosis to treatment (Sander, 2018, p. 51). Sander notes further that the implementation of the ecosystem approach, like spatial planning, includes an inherent tension between the rationalist/scientist tradition of the key importance of compiling a full overview ecosystem and the general willingness to decide and act, even without such information (Sander, 2018, p. 22). The HELCOM interpretation of the ecosystem approach, as well as its implementation, includes both elements.

While the implementation of the quantification aspects of the ecosystem approach and the quality-based regulation is justified by, and relies on, better management response (Cormier et al., 2016; Elliott et al., 2017) the added value of definitions and assessments of status in the actual identification and implementation of measures is not clear-cut. This is perhaps especially so in areas like the Baltic Sea where a reasonable level of knowledge has been available for a longer time. The status assessments and definitions consume resources which could also be used to specify and implement technical measures to solve known issues. Further, while it is true that more timely and integrated scientific assessments might help identifying new issues of concern and related measures, new topics commonly emerge to the regional agenda via global or EU -wide priorities, not initiated (even if later developed) by local scientific efforts. An example is the rapid rise of marine litter to the regional Baltic Sea and HELCOM agenda (2013-) which was preceded by a global campaign by several actors (e.g. Shevealy et al., 2012). A practical advantage of agreed environmental quality targets is that they can be used as input to

modelling and scenario building (Murray, 2019; Wulff, 2007; Zandersen et al., 2019) which in turn have a potential to influence the environmental policy processes. A related use of the definitions of good ecological status is also that these enable justifying measures both on a general level and as specific levels of pollution abatement, estimating cost efficiency of measures[42] as well as in general facilitate implementation of regulations based on economic incentives such as emission quota trading. As an example of a practical application, the nutrient emission reduction targets of BSAP were used as justifications for the measures in the HELCOM work to propose to IMO regional management measures to address pollution from ships in the Baltic Sea (IV). In addition, as discussed above, the work to define ecosystem quality has also a pedagogic value, where ecosystem science is learned as it is translated to policy. Concluding, for management measures, the main value of ecosystem approach implementation in terms of scientific assessment work seems to be in providing a more elaborate way for justifying, specifying and reporting the achievement of management action which has been identified and decided in other processes. The surprisingly persistent tradition on shipping measures within HELCOM will perhaps continue to remain as an exception, fuelled by the synergy with the work done by coastal countries and EU at the International Maritime Organization (IMO) (Paper IV).

The developments at HELCOM reflect the general tendencies in international environmental cooperation within the Baltic Sea region and beyond. The practice that individual countries are given nearly full freedom to select specific measures to reach the agreed management targets has been a characteristic feature of the last decades of Baltic Sea governance (Ringbom and Joas, 2018), related to general tendencies in environmental policy (Bernstein, 2000) and perhaps even the nature of international law (Koskenniemi, 2005). HELCOM environmental assessments, and regional cooperation at large, have to perform a balancing task as concrete recommendations for measures are easily perceived as infringements on the sovereignty of states but paradoxically, output without such recommendations are perceived as irrelevant (e.g. Jabbour and Flachsland, 2017). This kind of paradoxes are visible in HELCOM measures on politically sensitive issues such as agriculture, where measures are commonly presented in the form of lists[43] of possible measures, which coastal countries may use as inspiration for national implementation activities, not prescribing any technically specific rules (Paper V).

[42] One possible underlying factor for the promotion of the ecosystem approach in the EU context is the need for cost-benefit analyses of new measures as this task becomes much more feasible with quantified policy targets.

[43] E.g. “palette of measures”

7 CONCLUSIONS

In Chapter 3 the overall objectives of this thesis were outlines as:

- conclude whether HELCOM has implemented the ecosystem approach during 2003-2018.
- examine in general the specific features of the ecosystem approach concept as documented and implemented within HELCOM during 2003-2018 by proposing and using a conceptual framework for the ecosystem approach consisting of the three themes of quantification, integration, and measures (Figure 2);
- find out whether HELCOM work has changed during the 2003-2018, if so how, and whether observed changes can be attributed to the implementation of the ecosystem approach.

Based on Articles I-V and this summary the following conclusions can be made:

- During 2003-2018 HELCOM has implemented a particular version of the ecosystem approach with origins in the North Sea region, adopted by HELCOM as part of the EU Marine Strategy (2002) process and has evolved during subsequent regional implementation of the EU Marine Strategy Framework Directive (2008). Due to the central role of science-derived targets of ecosystem quality this HELCOM interpretation of the ecosystem approach has a different focus compared to the ecosystem approach as agreed in the context of the Convention on Biological Diversity (CDB).
- The ecosystem approach as implemented by HELCOM can be described by a conceptual framework (Figure 2) including the elements of quantification of ecosystem status, integration of policy and adoption and implementation of management measures, as follows:
    - The conceptual element of *quantification* is observable in the significant HELCOM efforts to define, monitor, assess and model a good status of the Baltic Sea ecosystem manifested in indicators as well as assessment products.
    - The conceptual element of policy *integration* is observable as a significant expansion of HELCOM activities in the fields of MSP, Fisheries and Agriculture. as well as via the regional elements of EU policies, primarily but not limited to MSFD. These developments have created new forms of regular cross-sectoral cooperation, engaging ministries, agencies and stakeholders which have previously not been involved in HELCOM work.
    - The conceptual element of *measures* is observable via the centrality given to agreement on management measures to improve the status of the Baltic Sea in the 2007 BSAP and later

HELCOM follow up. However, due to the flexibility given to concrete national implementation, and the limited data available on the details of this implementation beyond simple checklists, this study cannot conclude on the influence of the ecosystem approach in terms of concrete national implementation. In fact, in terms of measures the main value of HELCOM ecosystem approach implementation seems to be in providing a more elaborate ways for proposing, justifying, specifying, and reporting the achievement of management action which is ultimately decided in other processes.

- A doubling in the number person hours spent in HELCOM meetings 2008-2018 has taken place in parallel to the implementation of the ecosystem approach. An important contribution to this increase has been from new cross-sectoral groups in the fields of MSP, fisheries and agriculture which were established as part of the ecosystem implementation process. This increase is assumed to be reflecting earnest efforts and real interest from the participants to engage in regional work on improving the Baltic Sea marine environment. The clearer link to EU (MSFD) work has likely also made HELCOM more important, as an arena where interests need to be defended, with increasing participation as a result. The level and width of expertise needed to operationalize the science-based ecosystem assessment system (I) has also likely increased the number of persons involved in HELCOM work.
- Comparing the types of documents adopted by HELCOM in the beginning and end of the period 2003-2018 it can be observed that a shift has taken place from technical specifications and concrete emission standards to more assessment products & ecological quality standards. Interestingly, the shift in focus of organisational output has not influenced the relative share of scientific work in terms of meeting time, which has remained relatively stable during the 2003-2018 period.
- Due to their closely intertwined nature it was not possible to separate between the implementation of the MSFD and that of the ecosystem approach as such within HELCOM based on the collected material.

8 REFLECTION & FUTURE

This thesis and the constituting articles (I-V) emerged on the side of daily work over a 15-year period during which my research object, the ecosystem approach as implemented within HELCOM, and the entire research field, research on the ecosystem approach in the Baltic Sea and beyond, has evolved significantly.

My work tasks at the HELCOM Secretariat during 2004-2018, and thematic interest, evolved. From initial tasks with assessments, ecosystem targets and indicators I turned to MSP and eventually to regulation of the environmental impacts of industrial maritime activities (maritime transportation and fisheries). Thus, during my employment at HELCOM I was not involved in all activities related to the ecosystem approach implementation, and in many activities only marginally. Further, I was not employed by the organization 2019-2020 when writing this summary as well as Article V, which has enabled a step back from a civil servant to a more traditional research role and another, more distant, look at my past work.

The shifting baseline introduced by evolution of the field and my own occupation has introduced a "durability problem" (Nilsson, 2006) to my PhD work, especially concerning the earlier articles. Much of that which was unclear in the beginning of my work is now taken as self-evident, and inversely all conclusions made in the beginning are no longer valid. However, after reading my Articles in more detail and writing this summary I remain of the view that they retain whatever merits they might have had for the reader. The passing of time has also its benefits: I have been able to use a rapidly expanding work by other researchers, within and beyond the Baltic Sea region, which has revealed the diversity of interpretations and uses of the ecosystem approach concept.

In retrospect my research could have benefited from well-designed interview studies, in the early phases of the work (I). However, over the years very similar information as would be retrievable from interviews was collected during numerous HELCOM meetings as well as informal discussions with colleagues. Further, the formal discussions during meetings have also been documented by me or my colleagues and are also freely available online for further study. Thus, in the end the added value of interviews for this part of the study would likely have been minor. However, interviews could have clarified more the relationship between MSFD and ecosystem approach implementation within HELCOM.

The idea to use meeting participation data as a method for tracking the organizational developments arrived only late in the process, in 2019. An earlier timing for this innovation could also have provided for more research results if combined with other sources of data such as interviews of persons active in ecosystem approach implementation outside the HELCOM and Baltic

Sea. The use of the meeting time as a proxy for organizational work in the way as used in V might be in some respects a novel way to use meeting record data in research. In this case it could be considered as some sort of methodological innovation.

Further, even if ecosystem approach implementation is very dependent on the specific context, other attempts to implement the concept, also beyond the original setting (Langlet and Rayfuse, 2018a, p. 447; Sander, 2018), might consider the following additional observations emerging from this concluding article and studies I-V:

- Even if assessment systems based on quantitative indicators and targets on the state of a marine ecosystem are justified by close links to management, the extensive delays in ecosystem response to management measures limit their direct practical use in following management performance. This suggests that it could be worthwhile to consider, in addition, indicators of relevant human activities, drivers of change or of progress in the implementation on key management measures for reaching priority targets such as CART and MAI. One example of this kind of development could be data and an indicator reflecting the wastewater treatment plants in the catchment area, and by country, which reach the nutrient abatement levels recommended by HELCOM (2020b).
- For regional seas organizations scientific work on defining the state of the environment as a basis for management action is a traditional focus area. The implementation of this dimension of the ecosystem approach is for this reason likely an evolution, not a revolution, of the existing work. If done comprehensively, scientific definitions of good status and related assessments are undertakings which likely consume a large share of the overall institutional capacity. An incremental, stepwise work starting with general targets as applied within HELCOM (I) seems like a reasonable starting point.
- If a main value of ecosystem assessments is pedagogical, one possibly interesting strand for future research would be to develop further the collective learning dimension of assessments and indicator processes to the participating scientists, other involved persons and even the general public in the form of the final product.
- The integration element of the ecosystem approach involves the expansion of cooperation to new substance areas, regulatory regimes, professional groups, and worldviews beyond the traditional remit of work. This is in many ways a non-trivial undertaking which will likely require a long process of 'acclimatization' as well as a great deal of diplomatic effort and skills to enable the necessary mutual learning and dialogue. New meeting and groupwork methods could be tested to bring into light and bridge the differences involved.
- Even if stakeholder participation is often highlighted as important it might be difficult to achieve. Especially industrial stakeholders are

interested in concrete measures rather than abstract concepts (IV). Consequently, efforts to engage this kind of stakeholders in discussions on ecosystem approach implementation, or definitions of good status of the ecosystem, without concrete proposals for measures, are likely to fail. The involvement of stakeholders in HELCOM work could be studied in more depth, elucidating on the reasons, benefits, and disappointments of participation.

— The future oriented and forward-looking approach, inherent in the field of marine spatial planning, can also be used in marine management (Merrie, 2018; Zandersen et al., 2019) and could form an integral part of a future ecosystem approach implementation. As an example, and as pointed out by Varjopuro et al (2014), it would seem reasonable to consider the unavoidable systemic delays already in the design phase of a new initiative.

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The HELCOM system of a vision, strategic goals and ecological objectives: implementing an ecosystem approach to the management of human activities in the Baltic Sea

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ABSTRACT

1. Since signing the Helsinki Convention in 1974, the countries with coasts around the Baltic Sea have striven jointly within the Helsinki Commission (HELCOM) towards the ecological restoration of the Baltic Sea. The European Community signed the revised Convention in 1992.
2. Work under HELCOM includes implementing joint recommendations to curb pollution originating from land and marine sources, ensuring safer maritime traffic, and protecting biodiversity, for example, by setting up a network of Baltic Sea protected areas.
3. A new concept — the ecosystem approach to the management of human activities — was adopted by the Contracting Parties of HELCOM in 2003 to serve as the new framework for further efforts towards attaining good ecological status of the Baltic Sea.
4. Stepwise progress towards the development of quantitative definitions of good ecological status has been made since 2003 to implement the new approach: a common vision reflecting the ecosystem approach was adopted in 2004 and a number of more targeted goals and objectives were agreed in 2006.
5. The Contracting Parties to the Helsinki Convention will use the objectives adopted covering eutrophication, impacts of hazardous substances, and the overall status of biodiversity, including the impact of fisheries and shipping, to draft a new set of joint management actions.
6. In the future, an agreement under development among the Contracting Parties on indicators with quantitative targets will enable a quantitative assessment of 'good ecological status' and progress towards the goals of HELCOM, the Convention on Biological Diversity (CBD), as well European legislation concerning marine environmental protection.

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KEY WORDS: Baltic Sea; HELCOM; ecosystem approach; ecological objectives; ecological status; EU marine strategy; regional seas

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INTRODUCTION

The Baltic Sea (Figure 1), situated in northern Europe and bordered by Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden, is a 377 000 km^2 brackish-water basin with an average depth of less than 60 m and a relatively long (> 25 years) residence time of water in the main basin (Kullenberg, 1980). During the 20th century, the industrial, agricultural, and fishing activities of the human population (at present estimated to be 85 million) within the 1 500 000 km^2 drainage basin have resulted in a sea with basin-scale problems of eutrophication, build-up of hazardous chemical contaminants, and depleted natural resources (HELCOM, 2002b, 2003a). Owing to these various pressures, the state and trophic structure of the whole Baltic Sea ecosystem has changed (e.g. Elmgren, 1989) to the extent that the result has been described as a whole ecosystem regime shift *sensu* Scheffer *et al*. (2001) (e.g. Boesch *et al*., 2006).

Regional Seas Programmes and Conventions work for the protection of marine and coastal environments in 18 regions of the world (UNEP, 2006). In the Baltic Sea area, the Helsinki Commission (HELCOM) ensures the implementation of the Helsinki Convention signed by the coastal states in 1974 and revised in 1992. The European Community (EC) joined the revised Convention in 1992. The Convention aims to prevent and eliminate pollution from land-based and marine sources in order to promote the ecological restoration of the Baltic Sea area and the preservation of its ecological balance (HELCOM, 1992). Over 30 years of intergovernmental and national work has resulted in, among other things, reduced nutrient inputs, especially of phosphorus from point sources to the sea (HELCOM, 2003d), and an improved health status of large predatory vertebrates owing to reduced inputs, and thus reduced

Figure 1. The Baltic Sea including its main sub-regions, coastal countries (in bold), other countries within the catchment and catchment area. K.-G., Kattegatt; G.o.R, Gulf of Riga; G.o. Finland, Gulf of Finland; Ru., Russia; Rep., Republic.

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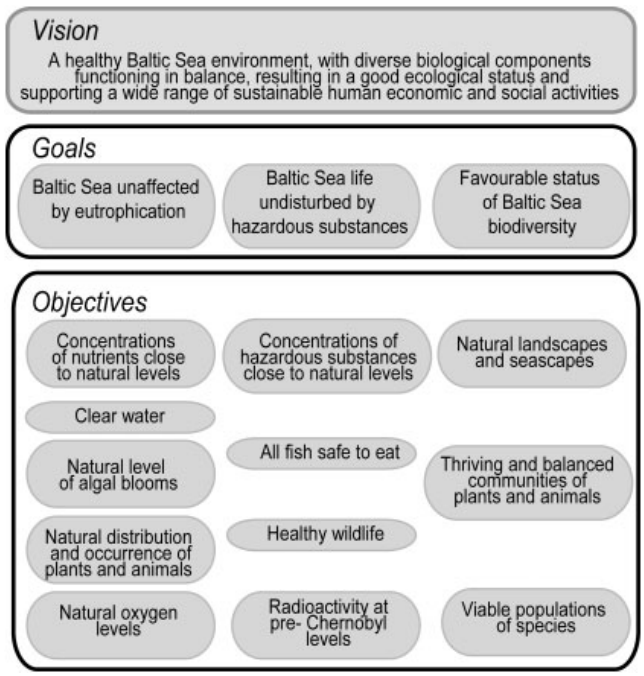

Figure 2. General outline of the HELCOM system of ecological objectives (modified from HELCOM, 2006a). For each objective, a number of indicators with target levels must be agreed upon.

bio-magnification, of hazardous substances (HELCOM, 2002b). Despite these positive developments, problems continue to persist. This is especially the case with eutrophication, which has proved to be difficult to combat because of self-reinforcing processes. These include high levels of phosphorus and nitrogen inputs combined with an internal load from sediment reserves (Pitkänen *et al*., 2001; Conley *et al*., 2002) and reduced de-nitrification in anoxic areas (Kuparinen and Tuominen, 2001), as well as excessive growth of cyanobacteria that fix atmospheric nitrogen (Finni *et al*., 2001; Poutanen and Nikkilä, 2001).

In order to accelerate joint efforts towards a cleaner Baltic Sea, HELCOM (2003b) and the joint HELCOM and OSPAR Commission (2003) Ministerial Declarations signed by the coastal states and the European Community adopted a new management concept, the ecosystem approach to the management of human activities to serve as the basis for national work coordinated within HELCOM. The joint Ministerial Declaration commits the Contracting Parties to further develop and apply measures necessary to implement an ecosystem approach by 2010. This includes developing and applying ecological objectives and appropriate indicators which express 'good quality status', as stipulated in the EU Water Framework Directive (WFD; Anon., 2000) valid for the inland and coastal waters of the EU Member States (see, for example, Andersen *et al*., 2004 for a practical application), but covering the whole Baltic Sea Area (HELCOM, 2003b).

In the ecosystem approach, the state of the ecosystem itself is used as a measure by which to identify, plan and implement management actions needed to combat pollution and to promote protection, as well as sustainable use and development, of the environment (Rice *et al*., 2005). The state of the ecosystem is defined by comparing the present level of selected indicators to agreed target levels representing a good, but not necessarily pristine, state (Andersen *et al*., 2004). In general, the holistic concepts characteristic of the ecosystem approach have been a part of the thinking of many Baltic Sea scientists for over half a century

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(Buch and Gripenberg, 1938; Jansson, 1972; Elmgren, 2001), which can also be seen in the wide thematic coverage of HELCOM environmental assessments (HELCOM, 1981, 1987, 1990, 1996, 2002b, 2003a). The novelty of the approach is the aim to quantify a good ecological status of the Baltic Sea. While the previous HELCOM management regime for nutrients was based on a flat 50% reduction target for land-based nitrogen and phosphorus inputs in relation to 1992 levels, the agreed ecosystem approach process aims at substituting these targets with those needed to reach good ecological status.

This article presents the first steps taken to define good ecological status of the Baltic Sea, as required by the 2003 Ministerial Declaration. The main emphasis is on the ecological objectives adopted by HELCOM Contracting Parties (Figure 2) (HELCOM, 2006a) and how they will be used as the basis for future work, such as commitments in ministerial declarations. The HELCOM Baltic Sea Action Plan, launched in 2006 and to be signed by Ministers of the Environment of the Contracting Parties in Krakow, Poland, in 2007, is being developed as a first practical implementation of the HELCOM Ecosystem Approach process and will be based on the ecological objectives described in this article. The Baltic Sea Action Plan and the HELCOM Ecosystem Approach process have also recently been identified (HELCOM, 2006a) as a pilot action under the emerging European framework legislation on the marine environment (Anon., 2005b).

STEPS TO DEFINING GOOD ECOLOGICAL STATUS

A specific HELCOM project was launched to coordinate the activity to implement the ecosystem approach. A stepwise process was adopted to create the necessary assessment tools (Figure 3). During 2004–2005 the project, guided by HELCOM working groups consisting of national experts, defined major features of the desired good ecological status including a vision, goals and objectives.

The aggregated HELCOM approach to assess the ecological status is based on annually updated online indicator factsheets, compiled in thematic reports and ultimately in overall environmental assessments. This system is in itself different from the traditional system based on bulky and less timely periodic assessments of the state of the environment, published at intervals of approximately five years (cf. HELCOM, 2003a).

In the assessment system adopted, the 'Vision' describes the overall ambition of HELCOM; 'Strategic goals' define major issues of concern (e.g. eutrophication); and ecological objectives describe central characteristics of a healthy sea (e.g. clear water). 'Indicators' (e.g. summertime Secchi depth) are the selected quantitative proxies of ecological state. Finally, the 'Targets' define the indicator values representing acceptable deviation from reference conditions, defined by historical background levels, modelling or expert judgement, for the given indicator and specified area.

The vision adopted by the Contracting Parties in 2004 (HELCOM, 2004) names 'biodiversity' in the spirit of the Convention on Biological Diversity (UNEP, 1992), as well as 'good ecological status' in the

Figure 3. HELCOM stepwise approach to define good ecological status (modified from HELCOM, 2006a).

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spirit of the WFD as essential components of a healthy Baltic Sea. The aim to reach 'ecological balance' in the Baltic environment is included in the 1992 Helsinki Convention text (HELCOM, 1992) and echoes the consensus reached at the United Nations Conference on Environment and Development (UNCED, 1992). The vision statement also emphasises one of the background reasons for HELCOM efforts to protect the Baltic Sea environment: its cultural values and ecosystem services important for human societies (HELCOM, 1992).

In addition to the vision, four strategic goals were adopted in 2006 to reflect the four main themes of concern under the management mandate of HELCOM. The strategic goals are a Baltic Sea unaffected by eutrophication, its life undisturbed by hazardous substances, and maritime activities carried out in an environmentally friendly way, all making possible a favourable status of the Baltic Sea biodiversity.

The objectives adopted by the Helsinki Commission at its 2006 meeting were developed to communicate and further define central ecosystem characteristics within the strategic goals. The objectives are the result of a combined consensus achieved in meetings of large numbers of experts representing science and management, based on draft documents prepared by the authors. Topics such as contamination of foodstuffs, clarity of water, and the well-being of species like seals and eagles were singled out as separate objectives. The objectives are described separately under strategic goals (Figure 2), reflecting the decision of the 2003 HELCOM Bremen Ministerial Meeting (HELCOM, 2003b), (i.e. eutrophication, hazardous substances, nature conservation and biodiversity, environmental impact of shipping). The HELCOM goal and objectives for maritime issues represent human pressures on, rather than the characteristics of, the Baltic Sea environment and are therefore not discussed in this article. The HELCOM system of a vision, strategic goals and objectives aim at a holistic approach and the goals and objectives are highly interlinked. As an example, natural landscapes and seascapes are not achievable without natural levels of algal blooms and oxygen, or viable populations of species without healthy wildlife.

Eutrophication

Concentrations of nutrients in the Baltic Sea have increased in most sub-basins during the past century owing to anthropogenic inputs (Larsson *et al*., 1985; HELCOM, 1987; Jonsson *et al*., 1990; Stigebrandt, 1991; Jonsson and Carman, 1994; Struck *et al*., 2000), resulting in a eutrophied ecosystem on a Baltic scale.

The clarity of sea water integrates many of the concrete effects of this process; the increased turbidity of Baltic Sea offshore waters during the 20th century (Sandén and Håkansson, 1996; Laamanen *et al*., 2004) is a result of increased planktonic primary production, including an intensification of phytoplankton blooms (Struck *et al*., 2000; Finni *et al*., 2001; Poutanen and Nikkilä, 2001; Raateoja *et al*., 2005).

The increased sedimentation of organic matter (Struck *et al*., 2000) has resulted in increased oxygen consumption in the sediments, causing oxygen depletion (Shaffer, 1979; Kullenberg, 1980; Stigebrandt, 1983) even in shallow bottoms (e.g. Rosenberg and Diaz, 1993), and leading to marked changes in zoobenthic communities, for example decimation of large bivalves, or even total elimination of fauna in deeper areas (Cederwall and Elmgren, 1980; HELCOM, 1990; Rumohr *et al*., 1996; Perus and Bonsdorff, 2004). Eutrophication has resulted in changes in the distribution of perennial macroscopic algae (Kautsky *et al*., 1986; Torn *et al*., 2006) and vascular plants (Kruk-Dowgiallo, 1991; Krause-Jensen *et al*., 2005) and also likely had an effect on Baltic fish stocks (Hansson and Rudstam, 1990; Thurow, 1997).

Hazardous substances

In the Baltic Sea area, as elsewhere, heavy metals and persistent organic pollutants were the first marine pollution problems taken seriously by environmental managers (Jensen *et al*., 1969; ICES, 1970) and especially persistent organic pollutants continue to cause problems (HELCOM, 2002b), even though regional measures to curb some classical substances like DDT and PCB have proved to be effective (Bignert *et al*., 1998; HELCOM, 2002b). Hazardous substances are often problematic for monitoring and

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assessment as they are usually released into the environment in low concentrations from diffuse sources such as consumer products or arrive in the sea via atmospheric deposition (HELCOM, 2005). For this reason, many substances are observed only when they have accumulated at the peak of the food chain (Jensen and Olsson, 1976) and in many cases only when concern due to human health risks is raised, such as occurred for dioxin compounds. Sometimes the only way to detect their impact is through applying biological effects monitoring, referring both to traditional observations of top-predator reproductive disorders (e.g. HELCOM, 2002b) and to novel biomarker methods (Hansson *et al*., 2006). Therefore, both hazardous substances concentrations and their biological effects on wildlife health have been included in the ecological objectives (Figure 2).

Fish represent the most common pathway of marine hazardous substances from the environment to humans, eventually affecting our own health. In order to preserve the commercial and cultural value of Baltic Sea fishing, all fish should be safe to eat by humans, but naturally also by wild predators.

Large amounts of radioactivity are released to nature only during exceptional events such as atmospheric test detonations of nuclear weapons during the 20th century and accidental releases like the 1986 Chernobyl accident. Presently, radioactivity in the Baltic Sea remains at higher than natural levels even though monitoring has shown a decreasing trend (HELCOM, 2003c).

General status of biodiversity

Although it is inherently imprecise (Haila and Kouki, 1994; Sheppard, 2006), the term *biodiversity* has been adopted in this system, supported by a separate goal and three dedicated objectives (Figure 2). This was to stress the importance of the well-being and favourable conservation status, as required by the EU Habitats Directive (Anon., 1992), of Baltic flora and fauna. The unique biological components of the Baltic Sea (Remane and Schlieper, 1958; Elmgren and Hill, 1997; HELCOM, 1998; Johannesson and André, 2006), have been observed to be under pressure, either due to direct resource extraction or to synergistic/unknown effects of various human activities. Owing to the unsettled discussions about the meaning of the biodiversity concept in general, the HELCOM objectives for biodiversity were left as general formulations reflecting the Convention on Biological Diversity (UNEP, 1992), focused on variability 'within species', 'between species' and 'of ecosystems'. This creates a link between national commitments in the context of the CBD with those within HELCOM.

The objective 'natural landscapes and seascapes' underlines the importance of diverse coastal and marine landscapes, including associated ecosystems, processes and cultural values, to the Baltic Sea environment. This objective is closely linked to the underlying ideas of the Baltic Sea Protected Area (BSPA) network (HELCOM, 1994), intended to cover different Baltic marine ecosystems and landscapes to ensure their protection. With this reasoning, the tools to assess the implementation status and ecological coherence of the network, presently under development as demanded by the HELCOM ministerial meeting in 2003, can be used to estimate the overall level of protection afforded to coastal and marine landscapes, as has been done in other fora (UNEP, 2004; Mace *et al*., 2005).

Thriving and balanced communities of plants and animals living within the marine landscapes are essential for a favourable status of the Baltic Sea biodiversity. Changes in the structure of communities can have cascading effects on their associated species and the ecological function of the ecosystem, as has been observed in the Baltic and elsewhere (Elmgren, 1989; Harvey *et al*., 2003; Scheffer and Carpenter, 2003; Österblom, 2006). For example, observed changes in Baltic plankton communities, such as increased algal blooms during the 20th century (Poutanen and Nikkilä, 2001), can have effects on entire food chains including other phytoplankton taxa (Suikkanen *et al*., 2004), zooplankton (Koski *et al*., 1999) and in this way even zooplanktivorous fish stocks (Flinkman *et al*., 1998). Such central Baltic sublittoral habitats as bladderwrack (*Fucus vesiculosus*) beds (Segerstråle, 1928, 1944), *Furcellaria lumbricalis* and blue mussel (*Mytilus edulis*) beds (Kautsky, 1974), and eelgrass (*Zostera marina*) meadows (Boström and Bonsdorff,

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2000) depend on a limited number of species as habitat builders but harbour diverse communities of fauna and flora.

The status of both whole ecosystems and communities often depends on viable populations of specific species characteristic to them. A viable population consists of a successfully breeding, healthy population that is able to maintain itself and perform its functional role in the community and ecosystem (Anon., 1992). The population trends of certain predator species of the Baltic Sea, such as the seals (Elmgren, 1989; Harding and Härkönen, 1999), white-tailed eagle (HELCOM, 2002a), salmon (Rappe and Soler, 1999; ICES, 2005) and cod (Gislason, 1999; MacKenzie *et al*., 2002; ICES, 2005), have an impact on the food webs, are relatively well known owing to long-term studies, and can quite readily be assessed.

Many fish species harvested by man are under intense pressure in the Baltic Sea (ICES, 2005). Fish stocks are an integral part of Baltic fauna and will be assessed in the adopted system under the strategic goal for biodiversity. Fisheries in the Baltic Sea were managed by the International Baltic Sea Fishery Commission until January 2006; at present the Baltic fisheries quotas are set by bilateral agreements between Russia and the European Community. However, fish stocks of commercial and recreational interest, as well as the environmental effects of fisheries, have been traditionally and naturally included in the HELCOM periodic assessments (HELCOM, 1990, 1993, 1996, 2002b, 2003a).

Threatened and declining species in the marine environment are generally difficult to monitor, but the ecosystem changes resulting from eutrophication and contamination of the environment may result in an increasing number of local declines or even extirpations. The introduction of non-native species is another threat to the Baltic biodiversity, which is difficult to manage by the available methodology; ballast water treatment of cargo ships may be one way to reduce the currently threatening influx of alien species (Leppäkoski and Olenin, 2001).

INDICATORS AND TARGET LEVELS

The development of a coherent set of ecosystem assessment indicators to quantify good ecological status, and their associated ecological objectives, is a major task for present activities within the HELCOM ecosystem approach process (HELCOM, 2006a). It can be anticipated that some objectives, such as 'clear water' and 'natural nutrient concentrations', can be assessed with one or only a few indicators, while other objectives may need several indicators for quantification, especially such objectives as 'healthy wildlife' and the three objectives under biodiversity (Figure 2). The aim is to use indicators which are based on existing, and emerging, monitoring programmes such as the HELCOM coordinated monitoring programme COMBINE. At present, approximately 20 annually updated indicator fact sheets are available on the HELCOM website covering some, but not all, ecological objectives.

Most importantly, the indicators should be provided with target levels reflecting favourable status. It is of central importance that the effects of global climate change to the Baltic Sea ecosystem (HELCOM, 2007) are acknowledged and that the shifting baseline syndrome (e.g. Pauly, 1995) is avoided by rigid scientific scrutiny of the underlying information when drafting and agreeing upon targets for the selected indicators.

Activities within HELCOM are at present engaged in this normative second phase of the ecosystem approach process: defining indicators with quantitative target or limit levels. The HELCOM report 'Development of Tools for Assessment of Eutrophication in the Baltic Sea' (HELCOM, 2006b) includes draft assessment criteria (i.e. quantitative boundaries of good state) for the different sub-basins of the Baltic Sea. Together with data from the joint HELCOM COMBINE monitoring programme, these criteria make assessment of the eutrophication status of the Baltic possible. Similar activities defining quantitative targets for indicators of hazardous substances and biodiversity are needed to cover the Ecosystem Approach.

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Table 1. A comparison of thematic coverage between HELCOM ecological objectives and CBD indicators (UNEP, 2004), the EU Water Framework Directive (WFD) (Anon., 2000) quality elements, other EC legislation in force such as the Habitats (Anon., 1992) and Birds (Anon., 1979) Directives, as well as the topics listed in Annex II of the proposed European Marine Strategy Directive (Anon., 2005b)

HELCOM ecological objectives	Convention on Biological Diversity 2010 indicators	EU Water Framework Directive elements (other EC legislation than WFD in parentheses)	Marine Strategy Directive proposal (Annex II) characteristics
—*Natural seascapes and landscapes* ● Implementation of ecologically coherent Marine Protected Areas (MPAs)	Trends in extent of selected biomes, ecosystems, and habitats Coverage of protected areas Connectivity/Fragmentation of ecosystems Area of forest, agricultural and aquaculture ecosystems under sustainable management	(Protection of habitats listed in Annexes of the EC Habitat Directive)	Predominant habitat types Special habitat types Special areas
—*Thriving and balanced communities of plants and animals* —*Distribution of plants and animals* —*Natural levels of algal blooms* The status of: ● Plankton communities ● Invertebrate bottom fauna ● Macroalgae and vascular plant communities ● Fish communities	Trends in extent of selected biomes, ecosystems, and habitats Marine Trophic Index	(Protection of habitats listed in Annexes of the EC Habitat Directive) Composition, abundance, and biomass of phytoplankton and frequency and intensity of blooms Composition and abundance of macroalgae and angiosperms Diversity and abundance of benthic invertebrate fauna and presence of disturbance-sensitive taxa Composition and abundance of fish fauna, especially disturbance-sensitive species	Biological communities, e.g. ● Phytoplankton ● Zooplankton ● Invertebrate bottom fauna ● Fish populations

—*Viable populations of species* Meaning the state of population parameters for: • Seals • Porpoises • Single fish stocks • Bird species of specific interest • Other threatened and declining species	Trends in abundance and distribution of selected species Change in status of threatened species Trends in genetic diversity of domesticated animals, cultivated plant and fish species of major socio-economic importance Numbers and cost of alien invasions	(EC Habitat and Birds Directives Annex species, EU Common Fisheries Policy fish stocks)	Population dynamics, natural and actual range and status of: • Marine mammals • Seabirds • Other species • Non-indigenous species
—*Concentrations of nutrients close to natural levels* —*Clear water* —*Natural oxygen levels*	Nitrogen deposition	General: Transparency, thermal conditions, oxygenation, salinity and nutrients	Nutrient enrichment
—*Concentrations of hazardous substances close to natural levels* —*All fish safe to eat* —*Healthy wildlife* —*Radioactivity at pre-Chernobyl levels*		Priority pollutants and other pollutants discharged in significant quantities	General state of chemical pollution

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LINKS TO OTHER INTERNATIONAL INITIATIVES

There are a number of conventions and other international environmental legislation relevant to the Baltic marine environment that have been signed by the Baltic Sea countries in a wider geographical context than HELCOM. Many of these entities have assessment and reporting requirements, and for this reason, harmonization is necessary in order to streamline information flows and to ensure that the same data are used for assessments originating from different organizations. Ideally, the national information compiled in the HELCOM context for the Baltic Sea should be applicable as regional marine input for international assessment efforts. Table 1 summarizes topics highlighted in proposed or existing EU Directives and in CBD documents.

With eight of the nine Contracting Parties of HELCOM belonging to the European Union, it is clear that the HELCOM ecosystem approach, and the exact definitions of good ecological status of the Baltic Sea environment, must also be harmonized with existing and emerging European environmental legislation. For coastal areas under the jurisdiction of the EU member states, such an indicator-based assessment system as anticipated in this article is at present emerging with the implementation of the EU WFD, defining a desirable state of the aquatic environment by quantitative target levels (e.g. Andersen *et al.*, 2004). Further, the implementation of Birds (Anon., 1979) and Habitats (Anon., 1992) Directives, which also cover marine species and habitats, require clear and measurable reference values and targets for favourable conservation status (Anon., 2006). For European offshore areas, the legal basis for developing such a classification system is at present at a preparatory stage. The European Marine Strategy (Anon., 2005a), as well as the proposal for a European Marine Framework Directive (Anon., 2005b) released by the European Commission in 2005, point towards the delineation of regional 'targets' for environmental work aiming at good environmental status of European seas by 2021. The Baltic Sea has been designated as a pilot area for this activity and targets will be developed as the natural end product of the HELCOM indicator developments.

The HELCOM Baltic Sea Action Plan, built on the system of vision, goals and objectives presented in this article, is considered as proactive implementation of the forthcoming European Marine Strategy. The HELCOM stepwise approach towards defining good ecological status could be considered by other European Regional Seas Conventions engaged in similar processes.

CONCLUSIONS AND PERSPECTIVES

Quantification of good ecological status is in itself a major challenge for conventional science (e.g. Funtowicz and Ravetz, 1993; Lubchenco, 1998). Information on complex ecosystem interactions, acting over various spatial and temporal scales, must be compiled and presented in a concise and clear, but also scientifically justifiable, manner.

However, it should be kept in mind that finalizing the objective–indicator–target system described here is only a preparatory step in moving towards the core of the ecosystem approach: targeted management actions. With a system of quantitative criteria of good ecological status in place, monitoring data combined with tools such as modern ecosystem models can be used to identify and quantify required reductions in relevant anthropogenic pressures to reach the ecological objectives (Wulff *et al.*, 2007). After this task is completed, all the effort needed should be devoted to producing clear advice on what exactly should be done to remedy the situation.

For management, the challenge is to accept good ecological status as a starting point in defining concrete management actions, for example the quantity of reductions in nutrient inputs needed to reach the ecological objectives. This is not self-evident, as can be observed from the track record of implementing the advice from scientists in fisheries quota agreements (e.g. Myers *et al.*, 1997; ICES, 2005). In contrast to the

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definition of good ecological status, the actual extent of implementation actions, for example the time frame to reach good status, is a managerial value judgement and will be decided upon according to political will and available resources.

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Viewpoint

HELCOM Baltic Sea Action Plan – A regional programme of measures for the marine environment based on the Ecosystem Approach

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ABSTRACT

The Helsinki Commission (HELCOM) Baltic Sea Action Plan, adopted by the coastal countries of the Baltic Sea and the European Community in November 2007, is a regional intergovernmental programme of measures for the protection and management of the marine environment explicitly based on the Ecosystem Approach. The Action Plan is structured around a set of Ecological Objectives used to define indicators and targets, including effect-based nutrient input ceilings, and to monitor implementation. The Action Plan strongly links Baltic marine environmental concerns to important socio-economic fields such as agriculture and fisheries and promotes cross-sectoral tools including marine spatial planning. Due to complementarities with the European Union (EU) Marine Strategy Framework Directive, the Action Plan is in essence a pilot for this process without neglecting the important role of the Russian Federation – the only Baltic coastal country not a member of the EU.

1. Introduction

Many environmental professionals have at times felt like the unknown politician who, at the sight of a new policy initiative, allegedly burst out in frustration with: "I do not want to see a single new Action Plan – I want action!". However, one should not forget that such initiatives have nearly always a substantial function behind the rhetoric. They allow the inclusion of expanding scientific knowledge and changing regulatory priorities to the implementation of environmental commitments (Birnie and Boyle, 2002). In this article, the contents of the Helsinki Commission (HELCOM) Baltic Sea Action Plan (BSAP or Action Plan) for the Baltic Sea marine environment, its relation to other international initiatives and legislation, particularly the EU Marine Strategy Framework Directive (EC, 2008) and some of the inherent challenges and risks are discussed.

The Ecosystem based approach to the management of human activities (Grumbine, 1994; Rice et al., 2005; HELCOM and OSPAR, 2003; Waltner-Toews et al., 2008), or in short the Ecosystem Approach emerged since the late 1990s as a central concept in international environmental commitments (Sherman and Duda, 1999; CBD, 2000). Ecosystem Approach is partly a new expression of an old idea; that of basing management of human activities in systems thinking (Waltner-Toews et al., 2008) in order to attain environmental sustainability (UNCED, 1992; Bosselmann, 2008). In broad terms it calls for adaptive, precautionary and knowledge based measures across national and administrative borders to protect and restore key ecological functions of our environment. For the future of the semi-enclosed Baltic Sea ecosystem, which has experienced a basin-scale shift in state and trophic structure during the 20th century (Boesch et al., 2006; Österblom et al., 2007), such co-ordinated regional programmes of measures are needed. The nine bordering countries (Fig. 1) jointly suffer from, and are responsible for, the degraded state of the sea.

Within HELCOM, the governing body of the "Convention on the Protection of the Marine Environment of the Baltic Sea Area" – more usually known as the Helsinki Convention (HELCOM, 1974, 1992) – an explicit regional implementation of this Ecosystem Approach was initiated in 2003, by the HELCOM and the joint HELCOM/OSPAR Ministerial Declarations (HELCOM, 2003a; HELCOM and OSPAR, 2003).

Since the 2003 Declarations, the HELCOM Contracting Parties (Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia, Sweden as well as the European Community) have developed and adopted a set of ecological and management objectives and, on the basis of these, developed a tailor-made regional implementation of the Ecosystem Approach. In 2007 the final document,

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Fig. 1. Baltic Sea Area with coastal countries, approximate catchment and main sub-basins indicated. KG = Kattegat, RU = Russian enclave of Kaliningrad, G.R. = Gulf of Riga, G. Finland = Gulf of Finland. Note that Gulf of Bothnia consists of two major parts – Bothnian Bay in the north and Bothnian Sea in the south.

the HELCOM Baltic Sea Action Plan (HELCOM, 2007a), was adopted by a HELCOM Ministerial Meeting. The agreement defines, especially in the case of eutrophication, "good status" of the Baltic marine environment and commits the Baltic coastal states to nutrient input ceilings and a suite of actions to reach such a status by 2021.

2. Previous management efforts and the need for new approaches

Human activities, both on the Baltic Sea itself and especially throughout its drainage area, have over the last centuries put considerable pressure on its marine ecosystem (see Elmgren, 2001 for a historical review and HELCOM, 2002, 2009a,b). Of the many environmental challenges, particularly four issues have been highlighted as critical over the years. The first is the ongoing wide-scale nutrient pollution, or eutrophication of the sea (1), which has emerged as a particularly difficult issue to address due to the importance of diffuse nutrient sources (HELCOM, 2005), such as agriculture, and self-reinforcing processes in the sea (internal loading). Further, hazardous substances (2) from various sources and risks connected to maritime traffic (3), e.g. of a major pollution incident, continue to have disturbing effects and potential to cause permanent damage. As a net result, the mentioned issues, as well as unsustainable practices in fishery, have all impacted the biodiversity (4) of the Baltic Sea, measured as e.g. the viability of populations of higher trophic taxa, including fish, (HELCOM, 2007b; ICES, 2007) or as the status of habitats like seagrass beds (HELCOM, 2007c).

In 1974 the Helsinki Convention (HELCOM, 1974, 1992) was signed as a regional intergovernmental response to these, and other relevant, issues. Since then a number of targeted rounds of joint national actions, punctuated by Ministerial Declarations, have been carried out to ensure its implementation and to address emerging challenges. An example is the work carried out to fulfill the 1988 HELCOM Ministerial Declaration goal of 50% reduction of pollution (hazardous substances and nutrients) emissions from the catchment as compared to the 1987 levels (HELCOM, 1988). The key concepts guiding the implementation of the 1988 Declaration, and later embedded in the revised Convention (HELCOM, 1992), were the Precautionary Principle, Best Available Technology and Best Environmental Practices (HELCOM, 1988; Lääne, 2001).

Despite such Ministerial commitments and some earnest national efforts resulting in positive signals (e.g. a ca. 40% reduction of N and P loads emissions from sources 1987–2000) (HELCOM, 2003b), the results of environmental assessments carried out at the turn of the century (e.g. HELCOM, 2002, 2003c) clearly showed that further wide-scale action was needed to fulfill the Helsinki Convention aims and obligations. In the case of eutrophication it was also evident that whereas nutrient input reductions until 2000 had been achieved at major point sources through, for example, improved waste-water treatment, achieving the needed further reductions in many of the HELCOM countries, especially Sweden, Finland, Denmark and Germany, would require addressing more firmly diffuse sources of nutrients such as run-off from agricultural lands and emissions from the transport sector. Agricultural measures to cut nutrient loads have been carried out since the early 1990s but the actual loads from this source, especially those of phosphorus, to the Baltic had not decreased by 2000, even if partly due to natural time lags (HELCOM, 2003b). The revival of eastern Baltic agriculture and economies from the late 1990s, especially since EU accession, underlined further the importance of diffuse sources (HELCOM, 2003b). Further, due to high differences in incremental costs in eutrophication abatement between HELCOM member states, progress could not be achieved cost-efficiently using equal percent wise reductions in pollution loads such as the 50% reduction target (e.g. Wulff et al., 2001).

3. From Ecological Objectives to management measures

The Bremen Ministerial Declarations (HELCOM, 2003a; HELCOM and OSPAR, 2003) initiated a new phase in the intergovernmental work conducted under HELCOM. With the adoption of the Ecosystem Approach, the Member States committed themselves to quantitatively define a desirable and measurable "good status" of the Baltic ecosystem, and develop further concrete steps towards reaching this status (HELCOM, 2003a). This aim was further strengthened by the parallel European work in implementing the EU Water Framework Directive (EC, 2000) and developing the Marine Strategy Framework Directive (EC, 2008), requiring similar definitions for the open sea and coastal waters. It should be noted that many of the holistic management aspects of Ecosystem Approach, such as attempts to cover not only specific types of pollution but also wider concerns regarding biodiversity and sustainable use of natural resources had already been enshrined in the revised 1992 Helsinki Convention i.a. through its relatively innovative Article 15 (HELCOM, 1992; Birnie, 1996).

The whole HELCOM process toward fulfilling the implementation of the Ecosystem Approach can roughly be divided into four parts: an initial preparatory phase defining aspirational objectives (2003–2006), a subsequent quantitative phase defining operational targets based on the objectives, drafting the dedicated plan of actions (2005–2007) and implementation of the actions (2008-).

The preparatory process, initiated in 2003, scoped through stakeholder consultation specific issues to be included in the Action Plan by developing an overall vision, strategic goals reflecting

the four identified priority issues as well as regional Baltic Sea Ecological Objectives for the future Baltic Sea (further discussed in Backer and Leppänen, 2008).

Although not quantitative as such, the adopted Ecological Objectives fulfilled an important practical and strategic function by defining, in the form of a political agreement, important characteristics requiring, and paving way for, further quantitative definitions through indicators (Backer and Leppänen, 2008). These were, and continue to be, developed in subsequent HELCOM assessment work (e.g. HELCOM, 2006, 2009a,b).

Building upon the achieved political agreement on the Ecological Objectives, a number of operational targets, as well as management actions, were developed during 2005–2007. Since 2006 these activities focused around the development of a document that details how to implement the Ecosystem Approach in the Baltic Sea – the HELCOM Baltic Sea Action Plan (BSAP).

The development of the BSAP actions was initially, beginning from spring 2006, co-ordinated by a task force group including all HELCOM Contracting Parties, as well as representatives from non-governmental (NGOs), and governmental, organisations. International financial institutions, e.g. Nordic Investment Bank (NIB) and Nordic Environmental Finance Corporation (NEFCO), were included in the group to ensure the future funding of concrete projects aiming at implementing the Action Plan e.g. improving waste-water treatment. The concrete development of the four thematic segments of the Action Plan, representing the four Strategic Goals of HELCOM, was assigned to a number of lead countries/organisations including also NGOs. The final phases of the development comprised political discussions between Contracting Parties including coastal countries and the European Commission. In these discussions other stakeholders were participating as observers. Parallel HELCOM assessment activities (e.g. HELCOM, 2006) provided the necessary scientific consensus for quantitative targets regarding e.g. water clarity (Table 1).

4. The Baltic Sea Action Plan

The HELCOM Baltic Sea Action Plan adopted in Krakow, Poland, on 15 November 2007, is a multilateral Ministerial Declaration in which the HELCOM contracting parties, coastal country Governments and the European Commission, commit themselves to carry out specific actions for achieving the agreed Ecological Objectives, and eventually a Baltic Sea in Good Environmental Status by 2021 (HELCOM, 2007a). A number of initial targets, as well as indicators to measure progress toward the commitments, are also included. Furthermore, the Action Plan distinguishes between measures that can be implemented at regional or national level, and measures that require implementation at EU or international levels. For the last two types of actions, the Action Plan commits the Contracting Parties to proactively reach regional consensus in the form of joint HELCOM inputs to relevant international processes. In the case of EU this includes Common Fisheries Policy, Common Agricultural Policy and controls over the marketing and use of chemicals. Global measures include those for shipping taken within the International Maritime Organization, IMO. In addition to the preamble and the four thematic segments, the Action Plan includes chapters on assessment, financing and implementation/review. Further, 10 technical recommendations including an amendment to the 1992 Helsinki Convention (parts of Annex III focusing on agriculture), initial environmental indicators and targets as well as a number of other documents were adopted as a part of the Action Plan.

Table 1
Initial target and present levels for summertime water transparency measured as Secchi disc depth in the different sub-basins adopted with the HELCOM Baltic Sea Action Plan (2007a: p. 78) and HELCOM (2006). The figures were used to calculate maximum allowable loads in Table 2.

Sub-region	Reference	Target	Present
Bothnian Bay	7.5	Present	5.8
Bothnian Sea	9.0	Present	7.0
Gulf of Finland	8.0	6.0	4.1
Baltic proper	9.3	7.0	6.3
Gulf of Riga	6.0	4.5	3.4
Kattegat	10.5	Present	8.5

4.1. Towards a Baltic Sea unaffected by eutrophication

From the very start it was clear that addressing excessive inputs of nitrogen and phosphorous was going to be a focal area of the Action Plan. The starting point was the first results of HELCOM assessment work to quantitatively define Good Environmental Status with regard to eutrophication (HELCOM, 2006), and efforts to combine pollution load models with ecosystem models in order to predict the environmental effects of various policies by the Baltic Nest Institute (BNI) (Savchuk and Wulff, 2007; Wulff et al., 2007). During 2006–2007, the BNI nutrient reduction scenarios were compared with acceptable inputs back-calculated from HELCOM target levels for eutrophication indicators, specifically those for water clarity measured as Secchi depth, included in the BSAP (Table 1). The results provided an estimate on how far existing HELCOM recommendations, as well as fully implemented EU legislation and programmes, will bring the Baltic towards the agreed targets, and thus the Ecological Objectives for eutrophication. Further, the scenarios defined the need for further actions, beyond these policies, in order to reach the BSAP strategic goal "Baltic Sea unaffected by eutrophication".

As a result of this work the adopted Action Plan includes tables of quantitative nutrient input ceilings, i.e. maximum allowable inputs for reaching agreed water clarity (as a proxy for good environmental status), for the whole Baltic Sea, and divided to sub-basins (Table 2). These input ceilings were compared with average 1997–2003 loads to define nutrient reduction requirements for the whole Baltic and its sub-basins (Table 2) well as countries (HELCOM, 2007a). The division of the required load reductions within a sub-basin among countries was done by first estimating the reductions achievable by full implementation of existing HELCOM and EU Urban Waste Water Directive commitments regarding waste-water treatment (e.g. 70% of N and 80% of P reduction for municipalities with more than 10,000 inhabitants). The national share of total loads to a sub-basin remaining after such measures was then used to calculate the share of the remaining reduction need. Compensation was given from national waste-water treatment requirements exceeding existing EU or HELCOM commitments. Atmospheric loads were included in the maximum allowable input estimations as a constant background, but not used for dividing reduction requirements among countries.

Specific HELCOM recommendations adopted within the Action Plan include those on increasing phosphorous removal in municipal waste-water treatment from 80% to 90% and substituting phosphorous in detergents. If implemented consistently in the catchment these two cost-efficient measures have the potential to reach nearly 40% of the required reductions for phosphorus (Wulff et al., 2007). To fulfil the agreed reduction quotas each Member State will have the flexibility to choose from these and other cost-efficient, or otherwise preferable measures, and to include them into their national BSAP implementation programmes by 2010. The BSAP encourages also further trans-boundary co-operation to initiate measures in non-HELCOM countries in the catchment, including Belarus and Ukraine (Fig. 1).

The Action Plan recognises that the bulk of unaddressed water–borne nutrient, particularly nitrogen, input originates from diffuse

Table 2
Nitrogen and phosphorus maximum allowable loads, mean inputs 1997–2003 (normalised for variations in riverine water flow) and input reduction requirements adopted with the HELCOM Baltic Sea Action Plan (2007a: p. 10). The values are given as divided by sub-basin and as a total figure for the whole Baltic Sea.

Sub-region	Maximum allowable input (tonnes)		Mean inputs 1997–2003 normalised for hydrology (tonnes)		Needed reductions (tonnes)	
	Phosphorus	Nitrogen	Phosphorus	Nitrogen	Phosphorus	Nitrogen
Bothnian Bay	2580	51 440	2580	51 440	0	0
Bothnian Sea	2460	56 790	2460	56 790	0	0
Gulf of Finland	4860	106 680	6860	112 680	2000	6000
Baltic proper	6750	233 250	19 250	327 260	12 500	94 000
Gulf of Riga	1430	78 400	2180	78 400	750	0
Danish Straits	1410	30 890	1410	45 890	0	15 000
Kattegat	1570	44 260	1570	64 260	0	20 000
Total	21 060	601 720	36 310	736 720	15 250	135 000

sources, mainly agriculture. Due to this, the Action Plan, and specifically the revision of the Helsinki Convention Annex III on land-based sources, requires countries to apply balanced strategies, optimising nutrient use and minimising nutrient fluxes, to agricultural practices including animal feeding, handling of manure and crop cultivation. To further ensure necessary integration of environmental concerns to agricultural policy, those Member States that are also members of EU committed themselves to a joint submission to the revision process of the European Common Agricultural Policy. The Action Plan also commits HELCOM to identify and list those major animal farms where actions should be prioritised.

Deposition resulting from airborne emissions of nitrogen from transport on land, shipping, and combustion processes play an important role especially in the total load of nitrogen. According to European Monitoring and Evaluation Programme (unpublished) estimates the depositions of nitrogen to the sea will not decrease, even if existing targets for nitrogen in the United Nations Economic Commission for Europe (UNECE) Gothenburg Protocol (UNECE, 1999) and the EU National Emission Ceiling Directive (EC, 2001) are reached due to e.g. increasing maritime traffic. Therefore, the Action Plan requires Contracting States to work for strengthened targets to be adopted within these organisations, taking into account also effects on the marine environment.

To address airborne nitrogen emissions from shipping, the Action Plan requires HELCOM countries to evaluate Baltic Sea specific environmental effects and the sufficiency of proposed (recently adopted) NOx emission control measures under MARPOL 73/78 Annex VI (Anon., 1978). The Action Plan also commits the Contracting Parties to initiate jointly within IMO amendments under Annex IV of the same convention to eliminate discharges of sewage from ships in the Baltic, as a first step from passenger ships and ferries.

4.2. Towards a Baltic Sea undisturbed by hazardous substances

The actions on hazardous substances in the Action Plan focus on nine organic substances and two heavy metals (Table 3), supplementing earlier HELCOM commitments (e.g. HELCOM, 1998a). The actions focus on banning and substituting the use of these substances in important sectors, within an agreed timetable, in the whole catchment area. Some of the addressed substances, such as brominated flame retardants and perfluoro-chemicals, have not been addressed in the HELCOM context earlier. As a significant share of both the air- and waterborne inputs of some heavy metals to the Baltic Sea originate in non-HELCOM countries (HELCOM, 2007d) the Action Plan stresses that Baltic concerns in this field should be taken into account also in other international fora.

Unfortunately, the information available on inputs and sources of hazardous substances was not as extensive as for nutrients, so it was not possible at the time to conduct a comprehensive assessment of the situation in the Baltic Sea based on quantitative indicators. With the Action Plan, the HELCOM countries have committed themselves to work together to build up more information about the sources, inputs and the occurrence of the selected hazardous substances in the Baltic marine environment. The Action Plan also highlights the need to strengthen the capacities of the relevant authorities and industries, in order to increase awareness of how pollution involving hazardous substances can be eliminated. Additionally, a whole effluent assessment approach, including possible limit values, will be developed and introduced to assess complex discharges of hazardous substances. Biological effects monitoring will also be developed to facilitate a reliable ecosystem assessment. The resulting knowledge can then be used as a basis for identifying further actions, and revising the list of selected substances.

Table 3
List of substances or substance groups targeted by the HELCOM Baltic Sea Action Plan (HELCOM, 2007a).

1. Dioxins (PCDD), furans (PCDF) and dioxin-like polychlorinated biphenyls
2a. Tributyltin compounds (TBT)
2b. Triphenyltin compounds (TPhT)
3a. Pentabromodiphenyl ether (pentaBDE)
3b. Octabromodiphenyl ether (octaBDE)
3c. Decabromodiphenyl ether (decaBDE)
4a. Perfluorooctane sulfonate (PFOS)
4b. Perfluorooctanoic acid (PFOA)
5. Hexabromocyclododecane (HBCDD)
6a. Nonylphenols (NP)
6b. Nonylphenol ethoxylates (NPE)
7a. Octylphenols (OP)
7b. Octylphenol ethoxylates (OPE)
8a. Short-chain chlorinated paraffins (SCCP or chloroalkanes, $C_{10–13}$)
8b. Medium-chain chlorinated paraffins (MCCP or chloroalkanes, $C_{14–17}$)
9. Endosulfan
10. Mercury
11. Cadmium

4.3. Towards a Baltic Sea with environmentally friendly maritime activities

In the field of maritime activities, the Action Plan complements the earlier HELCOM policies and other international legal regimes. It aims to ensure the ratification of the International Convention on the Control of Harmful Anti-fouling Systems on Ships (Anon., 2001) and Annex VI to MARPOL 73/78 (Anon., 1978) by all the Baltic Sea countries by 2010. Apart from the two joint submissions to IMO mentioned in the section on eutrophication, aiming for stricter international law for NOx emissions and sewage discharges from ships in eutrophied seas, the riparian countries have urged for further tightening of sulphur content in marine fuel oil both globally, as well as regionally through declaring the Baltic as a Sulphur Emission Control Area, or SECA, under Annex VI of MARPOL 73/78 Convention. Together with the European Maritime Safety

Agency the Baltic Sea countries have been improving detection of illegal oil discharges at sea by using comprehensive satellite surveillance, harmonised with aerial surveillance, as well as by extending a newly developed detection system based on the HELCOM Automatic Identification System (AIS), to ease identification of non-compliant ships entering the HELCOM area.

The Action Plan commits the HELCOM countries to take the necessary actions to further improve the safety of navigation in the Baltic Sea, including investigating how AIS information content exchanged between ships, as well as between ships and shore authorities, could be modified to better serve its aims. The new AIS messages, called AIS application-specific messages, proposed to IMO, based on i.a. Baltic Sea country efforts are expected to be adopted in May 2010. Speeding up the introduction of a general requirement for ships to use Electronic Chart Display and Information System (ECDIS) within IMO, for decreased risk of groundings and collisions, is also recommended. The amendment to International Convention for the Safety of Life at Sea (SOLAS) introducing phased-in ECDIS requirements were adopted in 2009. A special focus was put to enhanced safety of navigation during wintertime, which is to be achieved by training and increased readiness for co-ordinated icebreaker operations. Overall, the Action Plan aims to strengthen existing sub-regional co-operation with regard to response to pollution incidents at sea. By 2013, all sub-regions of the Baltic Sea should be fully prepared to cope with medium-sized oil spills affecting and requiring response from more than one country. An adequate level of preparedness to respond to accidental pollution involving hazardous substances is to be achieved by 2016.

4.4. Towards favourable status of Baltic Sea biodiversity

In addition to HELCOM concerns, biodiversity is also highlighted in the Action Plan in order to promote the fulfilment of marine aspects of other international obligations targeting the issue, such as the Convention on Biological Diversity (Anon., 1992) as well as the EU Habitats and Birds Directives (EC, 1992). Processes leading to ecosystem level changes, like eutrophication and climate change, are evidently of major importance for any biodiversity target. With this in mind, the BSAP points out that in addition to specific directly biodiversity related measures, in e.g. the fisheries sector, the goal of achieving a favourable conservation status for the biodiversity of the Baltic Sea cannot be reached without successfully implementing all segments of the Action Plan, as well as combating climate change.

The identification and filling of gaps in the existing network of Baltic Sea Protected Areas (HELCOM, 1994) with the intent to develop an ecologically coherent network, as well as defining fisheries management measures to be applied within the network, will be done by 2010.

As a novel concept, the biodiversity segment of the Action Plan commits the HELCOM countries to develop a trans-boundary process of intergovernmental marine spatial planning (e.g. Douvere and Ehler, 2008) for the Baltic Sea in order to ensure that e.g. the conservation of the marine environment and management of human socioeconomic activities such as shipping, fisheries and offshore constructions in the Baltic Sea region are balanced and considered within a common Ecosystem Approach based reference system. This topic provides perspectives of further integrating BSAP environmental concerns to other international regimes applied in the Baltic.

In order to enhance the balance between the sustainable use of marine natural resources and their protection, the Action Plan commits the HELCOM contracting parties to develop and implement long-term management plans for commercially exploited fish stocks so that they remain within safe biological limits; preventing catches of non-target species and under-sized fish; and devising long-term plans for the monitoring, protection and sustainable management of coastal fish species. These actions will be carried out by competent fisheries authorities in co-operation with the Baltic Sea Regional Advisory Council and HELCOM, mainly by 2012. The EU Member States around the Baltic will provide joint HELCOM input to the 2012 revision of the EU Common Fisheries Policy.

The most important vector of unintentional species introductions into aquatic environments is shipping, via ballast water and hull fouling. The BSAP requires Contracting States to ratify the International Convention for Control and Management of Ships' Ballast Water and Sediments (Anon., 2004) by 2013 and includes a 17 step road map to a harmonised implementation.

The Action Plan promotes overall further research to support the conservation of marine landscapes, habitats, communities and species. This work will involve developing detailed landscape and habitat maps and updating the HELCOM Red List of Baltic habitats/biotopes and biotope complexes (HELCOM, 1998b, 2007c). A comprehensive HELCOM Red list of Baltic Sea species, complementing the existing red list of fish species (HELCOM, 2007b) will also be produced by 2013.

4.5. Financing, implementation and review

The main sources of funding for the described actions include national budgets and EU structural funds, including the EU Cohesion Fund which aims to help new member states to implement EU Directives. Russia, as a non-EU country, will benefit from funding provided for high priority environmental projects through the e.g. bilateral agreements and the Northern Dimension Environmental Partnership fund. Regional trading of nutrient emission rights was considered during the drafting process and a targeted study by NEFCO was conducted to explore its possibilities but in the end was omitted from the BSAP as the Contracting Parties wanted more time to consider its practical implications.

The implementation of the Action Plan will be monitored and evaluated, as well as revised if needed, during a Ministerial Meeting in 2013 and 2010. Ongoing HELCOM assessment work (e.g. HELCOM, 2009a,b) will provide scientific input to this revision process according to an adaptive management framework (Mee et al., 2008).

5. Links to commitments within European and other frameworks

Ministerial Declarations are formal expressions of intent by the contracting parties involved, in the case of HELCOM BSAP this includes the nine coastal countries and the European Community. Even so it is clear that the ongoing work in developing and implementing BSAP commitments gain additional strength from parallel processes under other international legislative frameworks, especially EU Law. In this respect the link between the BSAP and the EU Marine Strategy Framework Directive (EU MSFD) (Borja, 2006; EC, 2008) is particularly interesting.

If looking at the process from the outside it can likely be argued that through the BSAP process described in this paper the Baltic EU member countries have taken a proactive approach to implementing the EU MSFD. By adopting the Baltic Sea Action Plan in 2007 they have completed a practically identical set of steps as those for an EU MSFD programme of measures, eight years ahead of the 2015 deadline in the Directive (see Table 4 for a comparison between EU MSFD and BSAP activities). The minor difference between deadline years for reaching Good Environmental Status, 2020 (EU MSFD) and 2021 (BSAP) is the result of final amendment rounds to EU MSFD (c.f. Borja, 2006) which were not reflected in BSAP.

Table 4
EU Marine Strategy framework Directive (EC, 2008) requirements for EU Member States compared to completed, or ongoing, HELCOM and specifically BSAP (HELCOM, 2007a) related activities.

EU MSFD (EC, 2008) requirements	Comparable HELCOM BSAP (HELCOM, 2007a) activities
Baltic Sea is identified as a separate marine region (Article 4). Each EU Member State shall develop a marine strategy for its marine waters and ensure coordination within each marine region (Article 5) including non-EU member states (third countries, in Article 6). Within the region the member States should use existing regional institutional co-operation structures, including those under Regional Seas Conventions (Article 6)	Conclusion of Helsinki Convention 1974, revision 1992. Establishment of Helsinki Commission (HELCOM) as permanent governing body of the Helsinki Convention. HELCOM process to implement Ecosystem Approach (HELCOM, 2003a, 2007a; HELCOM and OSPAR, 2003) (since 2003)
Development of criteria and methodological standards for the determination of GES (Article 9) (by 2010) Complete an initial assessment of the current status of their marine waters and the environmental impact of human activities (Article 8) (by 2012) Establish and implement a co-ordinated monitoring programme for marine waters (Article 11) (by 2015)	HELCOM co-ordinated Monitoring started 1979. First joint HELCOM assessment on status 1981, loads 1987. Recent assessment products based on HELCOM monitoring include the HELCOM integrated thematic assessments on eutrophication (HELCOM, 2009a), biodiversity and nature conservation (2009b) as well as the hazardous substances assessment and a holistic overall assessment to be published by 2010
Determine a set of characteristics for GES (Art 9) and Establish a comprehensive set of environmental targets and associated indicators (Article 10) (by 2012)	HELCOM Vision, Goals and Ecological Objectives for BSAP (HELCOM, 2007a; Backer and Leppänen, 2008). Ongoing development of a core set of quantitative Indicators (HELCOM, 2006, 2009a,b) (explicitly since 2003)
Devising programme of measures which need to be taken in order to achieve or maintain GES (Article 13) (Identify the measures by 2015, entry into operation of a the programme by 2016)	Adoption, implementation and follow-up of HELCOM BSAP (HELCOM, 2007a)
Good Environmental Status 2020	Good Environmental Status 2021

In addition to evident links with the EU MSFD the Action Plan provides an opportunity to place other recent and related national efforts, e.g. those for defining good status of coastal waters according to the EU Water Framework Directive (EC, 2000), into a regional seas marine ecosystem framework. According to a recent EC communication (EC, 2009) the environmental part of the forthcoming EU Strategy for the Baltic Sea Region is structured according to the components of the BSAP, with the addition of climate change as a separate element.

6. Discussion

The BSAP covers the whole chain of actions commonly identified as characteristic for the Ecosystem Approach (Grumbine, 1994; HELCOM and OSPAR, 2003; Rice et al., 2005; EC, 2008; Mee et al., 2008). This includes taking a systemic approach and defining a vision, goals and objectives, indicators, environmental targets (i.e. good status) and input ceilings and finally concrete management actions, including an adaptive implementation and revision mechanism based on scientific assessments. In the case of BSAP this chain is particularly complete in the case for the eutrophication segment but is also applied for other issues, i.e. hazardous substances, biodiversity and maritime activities. Combined with the wide thematic coverage the HELCOM Baltic Sea Action Plan (BSAP) can be argued to be the first adopted full-scale regional intergovernmental programme of actions for the marine environment explicitly based on the Ecosystem Approach concept.

In a regional intergovernmental context, quantitative effect-based targets like the nutrient input ceilings of the BSAP (Table 2) can be compared to the critical loads of airborne pollutants defined by UNECE (1999). For marine waterborne pollution, this is globally a novel approach. Particularly in the described case of nutrient pollution the Action Plan can be seen as an example of a successful science-policy process: the scientific community has managed to recommend estimates of concrete targets (and indicators) constituting the content of a regional policy, and moreover the policy makers have had the political will to adopt these as a part of a Ministerial level action plan.

6.1. Challenges

Needless to say, the BSAP is by no means a perfect document despite its innovative sides. As an example the country-wise reduction targets were adopted as "provisional" only, referring partly to the adaptive process (Mee et al., 2008) aimed at, but no doubt also opening up for future softening of commitments if they prove to be financially or politically difficult to implement. Due to reluctance from HELCOM Contracting Parties, the plan does not either include strong commitments to specific agricultural measures to limit nutrient pollution, but restricts itself to recommendations and leaves decisions on such measures to national implementation plans to be elaborated later. Considering the central importance of agricultural measures to limit nutrient pollution this leaves many questions open. The political and practical challenges they represent have been apparent already during implementation of earlier HELCOM commitments such as the 1988 Declaration (HELCOM, 2003b). In the case of Baltic EU countries the reluctance is partly due to the fact that agricultural and fisheries related measures are, as EU members have delegated powers in these matters to the EC, dependant on separate activities within the EU. Regional fisheries management is conducted by bilateral negotiations between EU and Russia. The HELCOM Fisheries-Environment forum, established in 2008 as a platform for the needed direct regional exchanges between fisheries and environment Ministries in the region and EU Directorate Generals, might facilitate the needed dialogue in this field.

Overall the BSAP can be criticised because it includes a relatively large number of paragraphs referring, and urging, to activities that have to be carried out in fora other than HELCOM. However, as the existing marine management structures in the Baltic, and elsewhere, are fragmented between different sectoral frameworks this should not come as a complete surprise to anyone. It reflects the kind of institutional barriers which must be overcome to reach a more coherent and integrated management of marine ecosystems. Similar challenges apply also when implementing the EU MSFD (e.g. Borja, 2006). This fragmentation nevertheless means that if the decisions of countries or the European Commission, likely represented by other Ministries or services than environment, in such other fora do not live up to the BSAP commitments, then the progress towards reaching its aims is compromised. In addition to the issues already mentioned this includes decisions regarding addressing global climate change. Global economic difficulties encountered during 2008 have increasingly brought such internal tensions between exploitation and conservation to the surface, both within the Baltic riparian countries and in the EC as a whole. The Marine Spatial Planning

process (e.g. Douvere and Ehler, 2008) included in the Action Plan is one example of a future mechanism which might promote a more integrated regional management framework in the Baltic and elsewhere.

The possible contradictory effects of EU accession of Poland, Lithuania, Latvia and Estonia to nutrient pollution of the Baltic Sea provides a good illustration of the need for coherence. On one hand the European Directives on environmental issues have introduced many requirements which are likely to reduce nutrient loading, e.g. for waste-water treatment. However, at the same time the EC support to develop agriculture may actually increase nutrient load to the Baltic. In contrast the field of fisheries management might give the EU more credit from the environmental point of view; the EU Common Fisheries Policy has put limits to cod fisheries in the southern parts of the Baltic.

6.2. BSAP as MSFD pilot

Due to the evident complementarities and compatibility with the European Marine Strategy Framework Directive (see Table 4), the HELCOM Baltic Sea Action Plan was early on heralded as a pilot project for this European initiative. The European Community has described the adopted Action Plan as a cornerstone for further action in the Baltic Sea, including implementing the EU MSFD in the Baltic region (HELCOM, 2007e).

As one more indication of this relationship a letter was sent from HELCOM to the EU Commission in April 2009, pointing out the linkages between the HELCOM BSAP, the forthcoming EU Strategy for the Baltic Sea Region (EC, 2009) and the MSFD and its concept of a pilot project (see Article 5, §3 of that Directive). The letter opened a (still ongoing) discussion between the EU Commission and the HELCOM States being also EU members on this issue. It is still unclear what such a "pilot project" according to the EU MSFD could include in concrete terms as this is not spelled out in the Directive. A likely aim is to use such a pilot project status to ensure further EU funding to implement BSAP.

It is also evident that despite the clear substantial links between BSAP and Baltic EU MSFD an explicit legal link between the two frameworks, representing somewhat different degrees of obligation, will be non-trivial issue for many EU member states with Baltic coastline.

An interesting sideline in the Baltic EU MSFD context are also the future interactions between the required definitions of Good Environmental Status emerging from the European process and those definitions adopted regionally within HELCOM - both BSAP and beyond (HELCOM, 2006, 2009a,b and forthcoming HELCOM Holistic assessment 2010).

However, even if a lot has been written here about the importance of EU processes the crucial role of Russia is of equally central importance in developing and implementing the Action Plan. A close co-operation between EU members and Russia is necessary in order to fully implement many of the BSAP commitments. This is also recognised in the MSFD which encourages EU member states to coordinate their actions with relevant non-member states.

7. Conclusions

Even if covering major challenges for the Baltic Sea and including new approaches the HELCOM BSAP is not a final recipe for a clean Baltic Sea. It is one step in an adaptive management process going on since signing of the Helsinki Convention in 1974.

As any new concept with policy dimensions emerges, it starts to evolve through debates and battles on definitions, fundamental principles and policy implications (e.g. Grumbine, 1994). Regardless of the outcome of such battles in terms of final substance given to wordings like Ecosystem Approach, or Good Environmental Status, a positive aspect of such new concepts lies in the momentum they carry. This momentum can be useful in itself for initiating new rounds of action based on the best available knowledge and approaches needed to address difficult old problems, like those of Baltic Sea pollution.

Synergy with the EU MSFD might well remedy the lack of "hardness" some critics think is a problem of commitments taken within Regional Seas agreements such as HELCOM BSAP. This can be further strengthened by the established link to the future EU Strategy for the Baltic Sea Region (EC, 2009).

Whether Ecosystem Approach, definitions of Good Environmental Status, BSAP, or the EU MSFD for that matter, in the end makes any difference for the Baltic Sea itself will be determined by the substance of national and EC implementation measures. Over the coming years these will be measured and evaluated by regional HELCOM monitoring and assessment work. A HELCOM Ministerial Meetings to be held in Moscow in 2010 and a subsequent meeting in 2013 are among the coming milestones where the eventual results, or failures, will be revealed.

The HELCOM Baltic Sea Action Plan, and the path followed to develop it, will hopefully serve as a useful example of possibilities, but naturally also of eventual pitfalls, in implementing the Ecosystem Approach in a regional trans-boundary setting.

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[All HELCOM documents are freely available from the website http://www.helcom.fi]

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Transboundary maritime spatial planning: a Baltic Sea perspective

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Abstract Maritime Spatial Planning is a new form of spatial planning emerging at the intersection of expanding demands for commercial use of marine space and increasing concerns for marine ecosystems. Many coastal countries around Europe are presently engaged in this field -not only by their national activities but also cooperating across borders through transboundary dialogue, joint strategies and even considering joint planning. In the Baltic Sea region transboundary cooperation takes all these forms. Such activities, including the Plan Bothnia pilot planning of the Bothnian Sea between Sweden and Finland, bring into surface differences in planning procedures and approaches, views on the environment, compatibilities of geographical data and the general complexity of the international-national legal framework. Creativity and transparent, accountable procedures are needed to ensure that such initiatives are both useful and legitimate.

Keywords Marine · Management · Ecosystem · Sea · HELCOM · EU

Abbreviations

MSP	Maritime or Marine, Spatial Planning
EU	European Union
HELCOM	Helsinki Commission
VASAB	Visions and strategies for the Baltic Sea 2010
EIA	Environmental Impact Assessment
GIS	Geographic Information System
IMO	International Maritime Organisation
AIS	Automatic Identification System
BSPA	(HELCOM) Baltic Sea Protected Areas
EEZ	Exclusive Economic Zone
WWF	World Wide Fund for Nature

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Introduction

Until recently few spatial planners had seen the watery part of the world as belonging to their professional home turf. The area delineations visible in nautical charts provide nevertheless an illustration of past efforts to guide the spatial distribution of various activities taking place in the worlds seas. Today the popularity of applying spatial planning approaches to marine areas has blossomed to unseen proportions and a distinct field of study and practice is emerging as a result (Douvere and Ehler 2008; Ehler and Douvere 2009; Jay 2010). One important incentive for this development has been the awakening to a potential future shortage of space in coastal seas, partly a result of the rapidly expanding interest in offshore wind-power developments. At the same time marine ecosystems around the world are increasingly reported to be in a degraded state (e.g. UNEP 2010), creating public and expert pressure to constrain human activities.

In addition to global attention and pioneering national initiatives this surge in interest for MSP applies also in the European context, where ambitious aims to increase the share of renewable sources in energy production are being implemented (e.g. EU 2011a). In the European Maritime Policy (EU 2007a), the overarching European Union (EU)

document on marine issues, its work plan (EU 2007b) as well as in targeted documents like the EU maritime spatial planning roadmap (EU 2008a) maritime spatial planning is highlighted as a tool for both the restoration, and environmentally sustainable development, of European seas. Also the EU Marine (Strategy Framework) Directive (EU 2008b), aiming to reach good environmental status of European seas by 2020, names in its Annex VI *Spatial and temporal distribution controls* among measures to be considered when implementing the Directive.

As any type of spatial planning (Hall 2002) planning at sea can be conducted on a number of spatial scales, ranging from near shore waters of a local municipality to the marine jurisdiction of a given country including the Exclusive Economic Zone (EEZ), and even beyond to entire transboundary marine regions. The subject of this paper is the latter, strategic type of planning carried out through different forms of intergovernmental interaction. Besides general discussion the recent transboundary developments in the Baltic Sea region will be covered for illustration purposes.

Note that there are slight differences in terminology used by different initiatives planning the world seas including i.a. *marine spatial planning* and the EU Commission term *maritime spatial planning*. However, it is evident that the underlying idea behind these concepts, a cross-boundary, cross-sectoral and usually ecosystem based spatial organisation of human activities is largely identical. Due to clarity, and as the topic of this special issue is EU activities, the term *maritime spatial planning* is used in the remainder of the paper. However, *marine* remains a more commonly used prefix for the concept internationally (Ehler and Douvere 2009; Douvere and Ehler 2008).

Planning, maritime spatial planning and the transboundary dimension

In the general sense *planning* is the process of creating and maintaining a structured set of activities, a *plan*, required to reach an agreed, and desired, goal (Hall 2002). One example of a regional transboundary plan is the ecosystem approach based HELCOM Baltic Sea Action Plan, aiming at restoring the Baltic Sea marine environment by 2021 (HELCOM 2007a). *Spatial planning*, including variants like strategic spatial planning (Friedmann et al. 2004), on the other hand refer also to the meaning of the word *plan* as a physical representation of reality, and to the planning methods used by the public sector to influence the future distribution of people and activities in space (Hall 2002).

Spatial planning is commonly perceived as necessary to guide, and create better coordination between, different uses of space in advance and thus to protect common interests from unsustainable exploitation of finite spatial resources. Despite such idealistic aims spatial planning has also been a tool for powerful real estate developers -and it remains a paradox that the urban environments and buildings the most attractive to many of us, including those of the historical cities in Europe, were realised without plans of modern kind (e.g. Siegel 2010).

Whereas public spatial planning during the 20th century focused largely on promoting social and economic prosperity, it is today seen also as an answer to the challenge of reaching long term environmental sustainability of our societies (Hall 2002; McHarg 2006). However, some professional re-orientation is needed to enable this, as spatial planning has traditionally tended to have an implicit bias toward legitimising and promoting more human intervention. Restrictions needed to address environmental concerns, have usually been done by other means (e.g. Siegel 2010).

In any case, following the traditional usage of the term in northern Europe, the main tool in spatial planning is a legal document called a *spatial plan.* This commonly includes two interrelated parts: 1) text specifying important visions, goals, principles, priorities and underlying reasoning of the plan as well as providing additional guidance in interpreting part 2), a more or less legally binding map showing the spatial distribution of different activities and functions. Spatial strategies covering development in an entire country (e.g. Anon. 2002), or a bigger transboundary area like Europe (EU 1999) the map based approach is usually omitted even if these might be supported by maps as illustrations. But then again such documents are not usually called spatial plans but something else, e.g. “strategies” (e.g. Hall 2002; Friedmann et al. 2004).

Even if real world applications are usually less straight forward, theoretical descriptions of cyclic, adaptive processes stepwise leading to spatial plans have been included in basic texts of spatial planning since the 1960s (Hall 2002). Commonly mentioned steps include e.g.: 1) defining overall aims and other principles, like how public consultation is to be carried out 2) defining scale and scope of the plan, 3) analysis of status quo, 4) scenarios of possible futures 5) producing final plan 6) implementation and enforcement 7) monitoring and revision (Hall 2002; Ehler and Douvere 2009; Ekebom et al. 2008). This is evidently very similar to schematics depicting the development of any adaptive type of policy and management, such as those recently put forward in connection to ecosystem based approaches to marine management (e.g. Backer 2008).

Today, in contrast to earlier times, spatial plans on land are usually not entirely dictated by a narrow circle of expert planners. Instead, plans are developed in several distinct steps with public consultation in between (Hall 2002). In

societies with democratic claims this is needed to ensure legitimacy, and perhaps also cross-sectoral balance of the product. This type of planning can be seen as a process where actors, facilitated by the planner, agree on a plan guided by their values and available background material including forecasts (Zaucha 2000; Hall 2002). Instead of being seen as exact engineering conducted by experts it emerges as an informed but creative art with aims of anchoring the final product to democratic, value-based decision making.

As the word planning indicates the aim of the activity is to influence the future. A pro-active, long term, and precautionary approach to spatial management is thus a fundamental feature of spatial planning (e.g. Landau 1972). The practice resulting from planning decisions might well create long lasting patterns of practice, and even customary law, which is difficult to change later.

Maritime Spatial Planning (MSP) is in many ways an expansion of the approaches described above to marine areas even if the main proponents of this approach have been marine management professionals, not those who traditionally have called themselves spatial planners (Jay 2010). Despite this conceptual link spatial planning at sea has its special features, and the novelty of the field allows perhaps also the establishment of new approaches. Characteristic features of MSP include the frequency of "flexible" activities not completely excluding other uses (e.g. traffic and fisheries) and the three dimensional nature of marine space (e.g. covering both the sea-bed and the water surface) (Ehler and Douvere 2009). The environmental focus is also more evident in marine planning if compared with that traditionally taking place on land (Jay 2010). In the task of ensuring the protection of environmental integrity, or in other words implementing the ecosystem approach, MSP can be thought to deliver the necessary spatial controls, even if also other measures based on performance are needed (Douvere 2008).

A further difference seems to be the focus on scientific and "rational" approaches emphasised in marine planning writings (Jay 2010). Even if a understandable result of the marine management, and science, origins of the concept, the latter brings inevitably into mind the blind idealism, and dystopian results, of modernist rational urban planning of the early 20th century conducted by technical experts (Hall 2002; Siegel 2010). Scepticism toward purely rational approaches seems especially warranted considering the uncertainties in the data available from the seas (Jay 2010).

One of the main appeals of MSP for the public administration is likely its strive for better coordination and harmonization between existing fragmented management frameworks covering i.a. fisheries, maritime traffic and the environment (Ehler and Douvere 2009). Since the mid-20th century there have been numerous calls for a more integrated management of the world's seas, but even today the necessary coordination is still in concrete terms well beyond the horizon. However, when the spatial conflicts over the sea space start to grow seriously, e.g. as a result of developments like that of wind power, this traditional piecemeal approach meets its limits and MSP becomes a seriously attractive tool (Ehler and Douvere 2009).

The spatial and cross border dimensions of regional ecosystems, as well as the international nature of human activities linked to seas raise, somewhat naturally, the issue of transboundary cooperation on maritime planning. Thus, in addition to calls for national implementation of maritime planning the recent European Union process promotes cooperation across borders to ensure coherence of national maritime spatial plans, standards and processes across ecosystems (EU 2008a). This can be interpreted as anything ranging from information exchange through some extended form of transboundary bilateral consultations and finally to truly transnational, joint regional processes and plans. Due to the involvement of intergovernmental politics, the latter types of initiatives would be even more pioneering than regular national or municipal MSP. A possibly facilitating factor is that the international agenda is somewhat more self-evident in the maritime sphere compared to terrestrial, or even coastal, planning due to the nature and history of activities such as shipping. Another is the emphasis on broad patterns, rather than details, which seems to be a general feature of spatial planning at sea (Jay 2010).

Regular (i.e. mainly terrestrial) spatial planning policy processes in the EU context provide ample examples of the kind of difficulties encountered in the field of transboundary spatial development and planning (Faludi 2007). An illustrating fact is that due to reluctant member state positions the spatial dimensions of joint European development have been traditionally promoted with other approaches than spatial planning, more limited in scope (e.g. Territorial Cohesion, Territorial Agenda) (EU 1999; Faludi 2007). The underlying themes and approaches for such Europe-wide spatial strategies are also somewhat restricted by the EU context itself. Despite diversification of issues the overall aims of the EU remain centred around economic growth and its fair distribution over the European territory.[1]

Beyond competing national interests the challenges for any transboundary planning process include also diverging present and historical views on planning, as well as on the

[1] It is quite illustrative that in the previous EU treaty (Treaty of Nice) the word "sustainable" was mainly used in phrases like "sustainable balance of payments", or in contexts where "sustainable economic development" could have been interpreted simply as "non-interrupted economic development". Slightly clearer wordings referring to environmental sustainable economic development is included in the present EU treaty (Treaty of Lisbon, Dec 2009-).

role of the public sector in general. Within the past EU cooperation on more traditional types of spatial planning it has become clear that understanding what transboundary planning actually means vary widely. Dutch and Germans seem to link such spatial planning to connotations of regulatory planning common in their national systems (Faludi 2007), the French link it to an largely economically based *aménagement du territoir* and finally, in the extreme end, the UK sees it as simply a type of proactive, forward looking policymaking (Faludi 2007). Similar differences in political positions and historical/cultural interpretations of planning exist also within specific European regions such as the Baltic Sea (Cieślak et al. 2009).

This said the present Lisbon treaty, valid since December 2009 (EU 2007c), raises "territorial cohesion" as a topic where the member countries and the EU Commission share powers. As the EU Commission is in 2011 also considering new EU action on MSP (EU 2011b) it seems this change in tone is also visible at sea. A parallel, likely supporting, process is the recent shared interests in the North Sea regarding coordinating the placement of wind power plants, and in constructing a joint transmission network, the North Sea "super grid".

The initiatives for EU level action on MSP raise interesting questions regarding the ideological framework under which the needed integration between different interests, characteristic of spatial planning, will take place. In terms of European approaches to MSP both the Integrated Maritime Policy and the EU Marine Directive (e.g. Art. 13, §3) call for such integration but from somewhat different underpinnings. Even with its aims of integration the Maritime Policy is driven by economic interests and prospects of job creation (EU 2007a). The EU Marine Directive, however, has its environmental aims which inevitably restrict human activities to the limits of the ecosystem. It seems reasonable to expect that integrations carried out from these two starting points will be different.

Facing such ideological controversies it is naturally tempting to seek for shortcuts, either by hiding behind expert authority and apparent rationalisation, by substantially empty strategies which seem to satisfy all the involved parties or, in the most blatant case, by simply marginalising one voice or another. Disregarding the last option the road of all-encompassing strategies has the evident problem that it provides no real guidance, and thus simply favours status quo and powerful actors over the weak. The road of rationalisation on its hand also neglects somewhat the fact that planning decisions are more often than not a matter of value decisions on "wicked" problems which can't be calculated away (Rittel and Webber 1973). Regardless of the path taken the legitimacy of any transboundary dimensions of MSP will be rooted in the perceived transparency and accountability of procedures, as well as the professional integrity of the people involved – much similar to a field like international law (Koskenniemi 2007).

Towards regional transboundary MSP –a Baltic example

The Baltic Sea provides a good regional case study for illustrating the complexity of issues at play in the transboundary dimensions of maritime spatial planning. The results of recent assessments of the Baltic Sea marine environment recognize that it remains in degraded environmental status (HELCOM 2009b; HELCOM 2009a). A multitude of human activities, both on the sea itself and its catchment contribute to economic prosperity but are the cause of this degradation (HELCOM 2009b; HELCOM 2009a; HELCOM 2010). Human activities offshore include e.g. intensive marine traffic, industrial fisheries (mainly of cod, herring and sprat), leisure boating as well as construction and operation of technical installations such as offshore oil platforms, wind power farms as well as cables and pipelines (HELCOM 2009a) -such as the recently launched gas pipeline project between Russia and Germany.

As elsewhere these, and other relevant issues like agriculture, have regionally, nationally and within the EU been traditionally legislated and managed sector-wise. The challenges to implement cross sectorial policies, like MSP, in the region can be seen in the somewhat limping attempts to translate ecosystem based commitments and goals agreed within HELCOM (HELCOM 2007a) to concrete national and EC implementation in certain sensitive fields like agriculture and fisheries. Similar difficulties are likely to be faced in implementing the recent EU Strategy for the Baltic Sea Region (EU 2009).

Existing regional information

To get the overview of the situation needed for planning, the best available information on human activities and environmental parameters should be collected to the same system and available for simultaneous multi-layer map display, reference and analysis, following the approach pioneered by i.a. McHarg (1969). Evidence based transboundary maritime planning requires thus a functional Geographic Information System (GIS) which breaks down the traditional divisions between i.a. socioeconomic (e.g. socioeconomic statistics) and environmental (e.g. environmental monitoring) datasets. The HELCOM GIS server is an example of such a regional information system, serving transboundary planning efforts. It includes a substantial amount of regionally compiled and freely downloadable geo-referenced data on various environmental topics, but also related to different aspects of human use e.g. maritime traffic.

Spatially explicit transboundary regulation in the Baltic Sea

It is clear that any type of transboundary MSP in the Baltic do not start from an empty table as both international and European law has many elements that are relevant for the issue (e.g. Maes 2008). Beyond national maritime borders themselves, and the rights and obligations they confer according to UNCLOS, many types of internationally agreed regional spatially explicit controls in the Baltic Sea are in place (Fig. 1). This includes regulations set by the International Maritime Organization (IMO), including traffic separation schemes and EU regulations on fisheries management (areas closed to fisheries). Other examples include regional marine protected area networks, such as Baltic Sea Protected Areas (BSPAs), Natura 2000 and Emerald sites.

Even if some questions remain open maritime boundaries between coastal states of the Baltic Sea have been settled to the degree which is not easy to find in another region of the world (Franckx 1996). Since the Baltic Sea is in the global perspective a fairly small enclosed sea, the EEZs are in practice much narrower than the maximum width of 200 nm set by UNCLOS and cover in practice all area outside territorial waters. The only exception is a narrow strip in the middle of Gulf of Finland, agreed among the coastal countries not to be designated as EEZ and remains "high seas" in legal terms.

In 2005 the International Maritime Organisation (IMO) designated the Baltic Sea area, excluding Russian Federation waters, as a Particularly Sensitive Sea Area (IMO 2005).

A number of special spatial restrictions apply to the maritime traffic in the Baltic (HELCOM 2008). Eight IMO Deep water Routes have been established for deep draught ships, including a transit route (Route T) through the shallow entrance to the Baltic Sea through Kattegat, the Great Belt and the Western Baltic. In addition, three mandatory reporting systems as well as 21 IMO traffic separation

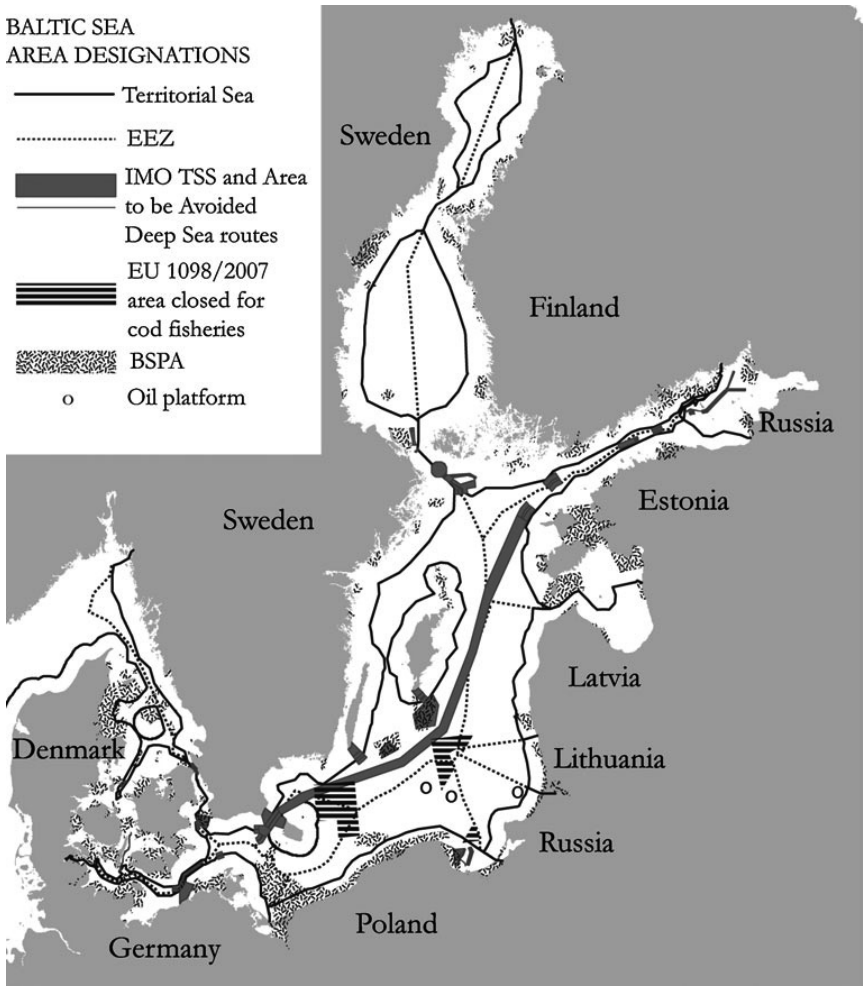

Fig. 1 Illustration of some of the existing spatial regulation applicable in the Baltic today. The included fisheries closures for cod apply only for certain periods each year

schemes and two areas to be avoided, south of the Gotland Island, are established and adopted by IMO by early 2011. To help in the follow-up of these measures the whole Baltic Sea area has been covered by a coordinated land-based monitoring system for ships based on Automatic Identification System (AIS) signals, from 1 July 2005. This information is available through the HELCOM AIS central website for national authorities and certain third party users.

By February 2010 the regional network of HELCOM MPAs, Baltic Sea Protected Areas (BSPAs), covered 159 sites. The total area of these amounts to a marine area of 42,823 km^2 which is over 10.3% of the total marine area (HELCOM 2010). In addition to the BSPAs a number of other protected areas have been established in the Baltic Sea including Natura 2000 sites network required by the EU Habitats and Birds Directives, and Emerald sites launched by the Council of Europe. Natura 2000 and Emerald sites are in practice part of the umbrella network of BSPAs, even if not all of these sites have been officially designated as such. If excluding overlaps the total share of Baltic Sea marine area protected by any of the three regimes was in 2010 over 12% (HELCOM 2010).

Since the closure of the International Baltic Sea Fishery Commission in 2005 the Baltic lost its formal platform for discussing regional fisheries issues between Baltic Sea states. Part of the resulting administrational void have been filled by i.a. the HELCOM Fisheries-Environment Forum, attended by both Fishery and Environment Ministry representatives since 2008, as well as through the fledgling cooperation under a new fisheries agreement signed between the EU and the Russian Federation in 2009. The EU multiannual plan for the cod stocks in the Baltic Sea (EU 2007d) regulates cod fisheries in specific areas and periods. EU guidelines for fisheries within Natura 2000 areas have been developed.

Processes linked to transboundary Environmental Impact Assessment (EIA) can be seen as one integral part of actually implementing the aims of MSP (Maes 2008). EIAs for transboundary projects, e.g. for the German –Russian North Stream pipeline at the time of writing under construction through the Baltic, is mainly governed by the Espoo Convention (UNECE 1991) even if other agreements have their own provisions like the Helsinki Convention (Article 7, HELCOM 1992). For spatial plans themselves the Strategic Environmental Assessment (SEA) protocol of the Espoo Convention (UNECE 2003), as well as the applicable EU law (EU 2001) create requirements to integrate environmental considerations, whether at sea or on land.

MSP in the Baltic Sea including regional transboundary cooperation

Several countries with Baltic Sea coastline have on going processes to strengthen national MSP, including German activities both in territorial waters and the EEZ -for which a plan was adopted in December 2009, pilot projects in Poland (Cieślak et al. 2009) and a recent Swedish government study and a forthcoming legislative proposal suggest national planning of the entire sea area including EEZ (Anon. 2010). Existing Finnish and Swedish legislation have enabled planning in territorial waters but the use of this possibility has been somewhat restricted. Through several different intergovernmental organizations the coastal countries are also presently orienting themselves in the transboundary dimension of Maritime Spatial Planning. The participating countries have naturally promoted slightly different aspects in the different organizations, depending on national interests, mandate of the cooperation activity and the persons involved.

Within the Helsinki Commission (HELCOM), the implementing body of the Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention) (originally signed in 1974, for the revised convention see: HELCOM 1992), MSP was put forward in 2003 with the adoption of the joint HELCOM-OSPAR statement on ecosystem approach which promotes spatial planning in marine areas. This was specified further in the HELCOM Baltic Sea Action Plan (BSAP) (HELCOM 2007a) where the coastal countries and European Commission committed themselves to adopt by 2010, as well as test, apply and evaluate by 2012, principles for regional broad-scale marine spatial planning in the Baltic Sea Area (HELCOM 2007a; HELCOM 2007b). VASAB, the regional cooperation body among spatial planning ministries, founded in 1992, included the topic in 2009 to a ministerial declaration (VASAB 2009) and has hosted a group on sea use planning since 2006 which has come with a technical report (Zaucha 2008) as well as a compendium on existing national approaches and activities (Cieślak et al. 2009). Beyond HELCOM and VASAB also the Nordic Council of Ministers, the organization for governmental cooperation between Nordic countries has carried out work on MSP. It is interesting to note the only piece of international treaty law focusing explicitly on the Baltic Sea is the 1992 Helsinki Convention.

In 2010 HELCOM and VASAB merged their activities by creating a joint intergovernmental group (HELCOM-VASAB MSP WG), with participation from i.a. all nine Baltic countries and the EU Commission, focusing on MSP as well as adopting a joint set of regional principles (see Box 1) to fulfil HELCOM commitments and complement EU level work (EU 2008a). Through the joint working group the two organisations can tap into the epistemic communities of both traditional spatial planning and marine and maritime management, and thus create the kind of dialogue called for recently by e.g. Jay (2010). In broad terms the principles in Box 1 is the first result of such a dialogue and aim to strike a balance between various approaches in the region to spatial planning at sea, including different views on the relative importance of environmental limits and development interests.

Box 1 The Baltic Sea broad-scale maritime spatial planning (MSP) principles. Adopted by member countries of HELCOM and VASAB and the EU Commission in December 2010 (Annex 3, Minutes of HELCOM HOD 34/2010)

1. Sustainable management

Maritime Spatial Planning is a key tool for sustainable management by balancing between economic, environmental, social and other interests in spatial allocations, by managing specific uses and coherently integrating sectoral planning, and by applying the ecosystem approach. When balancing interests and allocating uses in space and time, long-term and sustainable management should have priority.

2. Ecosystem approach

The ecosystem approach, calling for a cross-sectoral and sustainable management of human activities, is an overarching principle for Maritime Spatial Planning which aims at achieving a Baltic Sea ecosystem in good status -a healthy, productive and resilient condition so that it can provide the services humans want and need. The entire regional Baltic Sea ecosystem as well as sub-regional systems and all human activities taking place within it should be considered in this context. Maritime Spatial Planning must seek to protect and enhance the marine environment and thus should contribute to achieving Good Environmental Status according to the EU Marine Strategy Framework Directive and HELCOM Baltic Sea Action Plan.

3. Long term perspective and objectives

Maritime Spatial Planning should have a long term perspective in relation to the goals it seeks to attain and to its environmental, social, economic and territorial effects. It should aim for long-term sustainable uses that are not compromised by short term benefits and be based on long term visions strategies and action plans. Clear and effective objectives of Maritime Spatial Planning should be formulated based on these principles and national commitments. The establishment of a legal basis for Maritime Spatial Planning in the Baltic Sea countries should be investigated including vertically and horizontally well coordinated decision making processes concerning sea space uses to ensure efficient implementation of maritime spatial plans and to provide for an integrated sea space allocation process when such plans do not yet exist.

4. Precautionary Principle

Maritime Spatial Planning should be based on the Precautionary Principle. This implies planning has an obligation to anticipate potential adverse effects to the environment before they occur, taking into account Article 3 of the Helsinki Convention, and take all precautionary measures so that an activity will not result in significant harm. A similar, but distinct, forward looking perspective should be applied with respect to the economic and social dimensions.

5. Participation and Transparency

All relevant authorities and stakeholders in the Baltic Sea Region, including coastal municipalities as well as national and regional bodies, should be involved in maritime spatial planning initiatives at the earliest possible stage and public participation should be secured. Planning processes should be open and transparent and in accordance with international legislation.

6. High quality data and information basis

Maritime Spatial Planning should be based on best available and up to date comprehensive information of high quality that to the largest extent possible should be shared by all. This calls for close cooperation of relevant GIS and geo-statistical databases, including the HELCOM GIS, monitoring and research in order to facilitate a transboundary data exchange process that could lead to a harmonised pan-Baltic data and information base for planning. This base should cover historical baselines, present status as well as future projections of both environmental aspects and human activities. It should be as comprehensive, openly accessible and constantly updated as possible and compatibility with European and Global initiatives should be ensured.

7. Transnational coordination and consultation

Maritime spatial planning should be developed in a joint pan-Baltic dialogue with coordination and consultation between the Baltic Sea states, bearing in mind the need to apply international legislation and agreements and, for the HELCOM and VASAB EU member states, the EU acquis communitaire. Such dialogue should be conducted in a cross-sectoral context between all coastal countries, interested and competent organizations and stakeholders. Whenever possible maritime spatial plans should be developed and amended with the Baltic Sea Region perspective in mind.

8. Coherent terrestrial and maritime spatial planning

Spatial planning for land and for the sea should be tightly interlinked, consistent and supportive to each other. To the extent possible legal systems governing spatial planning on land and sea should be harmonised to achieve governance systems equally open to handle land and sea spatial challenges, problems and opportunities and to create synergies. Synergies with Integrated Coastal Zone Management should be strengthened in all BSR countries and in a cross-border setting.

9. Planning adapted to characteristics and special conditions at different areas

Maritime spatial planning should acknowledge the characteristics and special conditions of the different sub-basins of the Baltic Sea and their catchments. Consideration should be taken of the need for separate sub-regional planning adapted to such areas including sub-regional objectives supplementing regional objectives specified in principle 3. In general maritime spatial plans should seek coherence across ecosystems.

10. Continuous planning

Maritime spatial planning should reflect the fact that planning is a continuous process that will need to adapt to changing conditions and new knowledge. Monitoring and evaluation of the implementation of maritime plans and its environmental, as well as socio-economic, effects should be carried out with a view to identify unforeseen impacts and to improve planning data and methods. This monitoring and evaluation should, particularly in its transboundary dimensions and in addition to national and transboundary monitoring schemes, build on, and if possible be part of, regional monitoring and assessments carried out by regional organisations.

Also non-governmental regional Baltic actors like the World Wide Fund for Nature (WWF) and the Baltic Sea Regional Advisory Council, an advisory body linked to the EU Fisheries regime, have been active in discussions on MSP. In addition, a growing number of time-bound research projects have increased the available background

material for initiating maritime spatial planning in the Baltic (e.g. Heinrichs et al. 2005; Ekebom et al. 2008).

Despite the wide interest on MSP the enthusiasm of Baltic coastal states to concretely engage in cross-sectorial transboundary MSP processes evidently depends on the nature and extent of such cooperation. A process aiming at joint regional principles, abstract strategies or a dialogue on national implementation, as has been carried out so far, can be thought to be politically less problematic. However, even in such efforts the different national approaches to planning at sea regarding i.a. the status of environmental concerns, create friction witnessed during the drafting of the regional MSP principles. It is likely even more difficult to find consensus on more ambitious initiatives aiming for joint spatial planning across national borders covering parts of, or even the entire, Baltic Sea. Nevertheless, there are signs that such joint planning might after all not be that inconceivable, at least not in those parts of the Baltic Sea where the neighbouring countries share certain level of planning approaches and traditions. The recent initiative to try out joint maritime spatial planning of the entire Bothnian Sea is a good example.

The Bothnian Sea case

In 2010 Swedish and Finnish authorities, coordinated by the HELCOM secretariat and in partnership with VASAB, engaged in an EU-funded process labelled "Plan Bothnia" to try out strategic transboundary spatial planning approaches in this entire sea area, offshore from the outer border of inner waters, by 2012 (Fig. 2). For both countries this kind of offshore planning is a new type of activity. As mentioned, the existing planning regimes based on municipalities and regions, put in place after the Second World War, reach to the edge of the territorial sea (12 nm from the shoreline) even if implementation has so far mainly focused on dry land.

The challenges for the Bothnian Sea initiative include combining the planning and permit granting systems, national datasets, planning traditions and procedures of the two countries as well as navigating among the existing international agreements valid for the Baltic Sea, described earlier. The project was in its scoping phase at the time of writing but the likely planning topics include the "usual suspects" but with a regional twist: a growing maritime traffic, wind power developments interested in shallow areas, a considerable fisheries (mainly of herring and sprat by Finnish operators) and the concerns of nature protection. Not surprisingly the shallow banks in the area, like the Finngrundet banks in the Swedish EEZ, seem to be particular hotspots where various international uses and claims congregate (Fig. 2).

The initiative provides naturally also opportunities to innovate and test ways to more successfully combine environmental legislation (e.g. EU MSFD) with the needs of the maritime industry, fisheries (e.g. these aspects of the EU Maritime Policy) as well as recreation in a transboundary setting—i.e. to ponder on the planning implications of the ecosystem approach, and the related definitions of good environmental status (HELCOM 2007a, 2010; EU 2008b; Backer 2008). Even if Sweden and Finland see themselves as fairly progressive countries in terms of integrating environmental concerns to planning the inherent conflicts between private interests to exploit common resources, and public efforts to conserve them, make this kind of balancing always challenging.

Nevertheless, the advantage of having largely similar planning systems and approaches, a track record of good cooperation across the border (even joint regional planning in the shared Tornio-Haparanda urban area), the existing regional HELCOM GIS infrastructure and the informal status of the activity itself (no political adoption aimed at) Sweden and Finland might well end up with a successful case study of comprehensive, transboundary maritime planning by 2012.

Conclusions

Maritime Spatial Planning, like spatial planning on land, is a paradoxical process which aims to both legitimize development, boiling down to private profit making interests, and to protect public goods including unspoilt environment. It is seen as desirable due to its promise of more coordination in the fragmented field of marine policy. As is the case of processes within countries different political ideologies, worldviews and traditions in planning are also reflected in the discussions around transnational dimensions of spatial planning at sea, whether in a region like the Baltic Sea or Europe at large. In order to fulfil its central task of cross sectoral integration MSP should promote an open and transparent dialogue exposing the different underlying assumptions and thus enabling informed but essentially value-based decisions on desirable futures for our seas.

In the Baltic Sea there is relatively intensive transboundary cooperation and dialogue on MSP, recently focusing around a regional working group where the coastal countries and the EU Commission convene under two intergovernmental entities, HELCOM and VASAB. Besides functioning as a benchmark of present consensus on the topic the regional principles adopted in 2010 provide also valuable guidance for transboundary MSP foreseen by initiatives like the on-going pilot planning of the Bothnian Sea. Even if concrete spatial planning in the Baltic Sea will likely remain under national control it is evident that such forms of cooperation pave the way for more coherent planning between neighbouring countries and eventually the region as a whole. It should also enable more

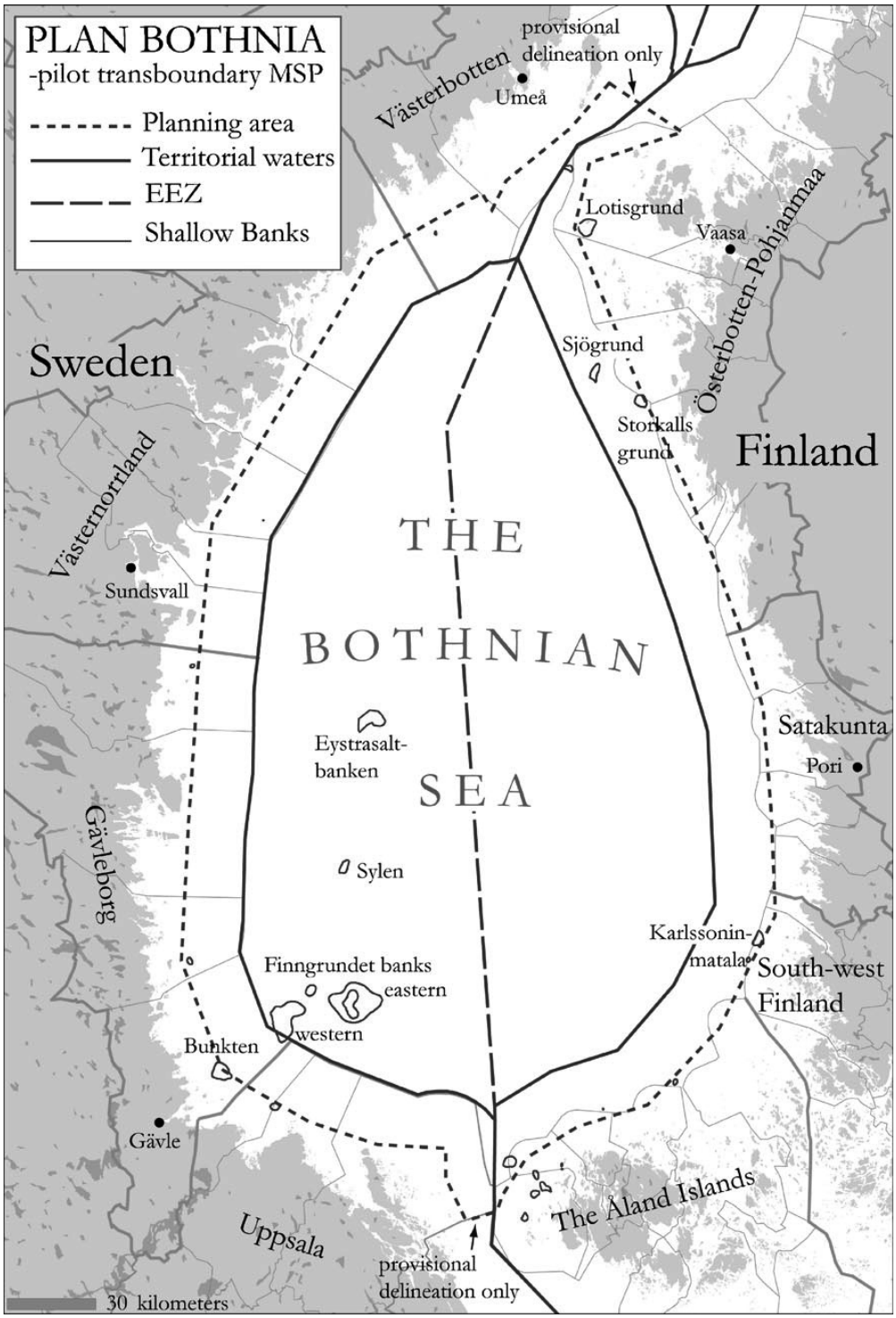

Fig. 2 A map of the Plan Bothnia planning area including national and sub-national borders and central geographic features including shallow banks

compatible development of the spatial regulations inherent in existing sectoral regimes concerning i.a. maritime traffic routing, fisheries closures and protected areas -if such streamlining is seen as desirable by the coastal countries and the EU.

Even if traditional spatial planning on land has been de-facto a tool for promoting further exploitation of space for human use and private profit, one can envision a different path for the emerging field of MSP. While natural resources, like space, are clearly finite we humans seem to have the potential to organise our economies, technology and lifestyles in a way which enables both prosperity and healthy ecosystems. Transboundary maritime spatial planning, in the Bothnian Sea and elsewhere, can be one excellent means to take this sustainability challenge seriously and innovate in a frank and transparent way about the possibility to adjust human activities to ecosystem limits. But this potential will naturally materialise only if this is actively sought for beyond the convenient bushes of status quo.

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Regional work on prevention of pollution from ships in the Baltic Sea – A paradox or a global forerunner?

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A B S T R A C T

This article highlights the potential of regional organizations for preparing and following-up International Maritime Organization's (IMO) decisions aiming to reduce pollution from ship based sources. The work of the Helsinki Commission (HELCOM) in the Baltic Sea region on air pollution (SOx and NOx emission control), sewage from passenger ships and ballast water management (ballast water exchange and exemptions) is used an example. While the described initiatives have emerged, matured and are followed-up within a regional co-operation framework based on the 1992 Helsinki Convention and its Annex IV, they have been drafted with the IMO framework in mind and have gained international legal status. The resulting IMO rules have led to substantial reductions in pollution to the Baltic Sea. Besides synergy with IMO and EU policy also, common features in the described successful initiatives include long term work, usually a decade from launch to IMO decision, active lead countries, close cooperation with industry and civil society as well cooperation between different constituents of national administration.

1. Introduction

Regional intergovernmental organizations focusing on the marine environment cover 18 larger areas of the world's seas and oceans [1]. These “regional seas” organizations engage their members, coastal and nearby countries, to improve the environmental status of the targeted sea area [2, p. 356]. Achieving these overall aims requires addressing the impacts from a wide range of concrete human activities, both on land and at sea. The latter includes dealing with operational and accidental pollution from maritime transportation.

However, addressing pollution from ships on the regional level is not entirely straightforward due to the strong mandate of the International Maritime Organization (IMO), the competent United Nations (UN) body in these matters. Technical requirements and standards set at IMO are widely accepted as binding under international law [3] and these, not regional regulations, define the global minimum environmental performance of ships. Further, even if the actual operation of ships can be regulated independently by coastal states in their national waters, either alone or together with other like-minded states [3], IMO regulation is often preferred over regional initiatives as it enables wider compliance, also in nearby offshore waters.

Likely due to this strong role of the IMO, and the European Union (EU) in Europe, ship traffic is less commonly addressed in substance within regional seas organizations, beyond joint response arrangements to accidental spills [1]. For the same reason substantial activities of regional organizations in the field of maritime transportation might for some observers even resemble a contradiction in terms, a paradox.

Nevertheless, some regional seas organizations do engage in regular substantial work on pollution from maritime transportation. One example is the Baltic Sea Marine Environment Protection Commission (HELCOM), where cooperation on clean and safe shipping has been carried out since 1975 by the coastal countries of the Baltic Sea (today Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Sweden and the Russian Federation) and, since 1992, also the EU [4].

Abbreviations: BAT, best available technology; BMCM, Baltic Maritime Coordination Meeting; BPO, Baltic Ports Organization; BSAP, HELCOM Baltic Sea Action Plan; BSHC, Baltic Sea Hydrographic Commission; BWMC, International Convention for the Control and Management of Ships' Ballast Water and Sediments; CG, correspondence group; CLIA, Cruise Lines International Association; CP PRF, HELCOM Cooperation Platform on sewage Port Reception Facilities; EMEP, European Monitoring and Evaluation Programme; ESPO, The European Sea Ports Organization; HELCOM, Baltic Sea Marine Environment Protection Commission, Helsinki Commission; HOD, HELCOM Head of Delegation; IHO, International Hydrographic Organization; IMO, International Maritime Organization; MARPOL, International Convention for the Prevention of Pollution from Ships; MC REFAC, HELCOM ad hoc Working Group on Reception Facilities in Ports; MEPC, IMO Marine Environment Protection Committee; NECA, NOx Emission Control Area; NOx, nitrogen oxide; Paris MoU, Paris Memorandum of Understanding on Port State Control; SCR, selective catalytic reduction; SDG, Sustainable Development Goal; SECA, SOx Emission Control Area; SOx, sulphur oxide; WWF, World Wildlife Fund

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The work on pollution from ships within HELCOM is based on the Convention on the protection of the marine environment of the Baltic Sea (Helsinki Convention) [5], originally signed in 1974 and revised in 1992 [6], and its Annex IV which explicitly addresses the issue.

Even if purely regional recommendations are occasionally adopted, this clean shipping work within HELCOM has always been characterized by a high level of synergy with IMO work based on the Helsinki Convention Annex IV. This strand of regional work supports coastal countries in IMO processes by the preparation of proposals for new IMO measures in the Baltic Sea, particularly the International Convention for the Prevention of Pollution from Ships (MARPOL) "special areas", as well as by enabling regionally harmonized implementation of existing, global regulations [4]. Via the use of the IMO framework, enforcement concerns, sometimes voiced around purely regional measures, are also avoided as IMO instruments have a relatively high level of compliance.

This article highlights the synergy between Baltic Sea regional cooperation on pollution from ships and IMO work. After an introduction of the HELCOM framework, concrete examples are provided by three policy processes on clean shipping within HELCOM which have been closely related to parallel work at IMO. These include initiatives to reduce pollution to the Baltic Sea from airborne pollution from ships via amending Annex VI of (MARPOL), from sewage (via amending MARPOL Annex IV) and work on invasive species (Ballast Water Management Convention). The Baltic Sea Action Plan, a comprehensive plan of action for the Baltic Sea marine environment based on the "ecosystem approach" [7,8], is further used to illustrate the role of high level regional policy documents in these processes.

The core research material of this article is the official HELCOM and IMO meeting reports and other publications which are available for further study. In addition, the author has used first hand knowledge of the HELCOM negotiation processes from the period 2012 to 18, partly also from the period 2004 to 2012. Due to the personal involvement of the author in the studied processes including drafting of documents this article may be methodologically considered as an example of what is known as "design research" or "design science research" in engineering (information) sciences [9] or in social sciences as "insider action research" [10].

2. HELCOM maritime working group

Overall, Baltic Sea regional governance, like global governance [11], is not a structured hierarchical system but emerges as the sum of the myriad of interactions which take place in the region between people representing states and other collectives.

Despite this apparent regional chaos, certain organizations can nevertheless be regarded as thematic hubs in the region, for the purposes of traditional formal intergovernmental cooperation. These have explicit or implicit mandates from the coastal countries to draft and adopt formal regional international policy and even law. Consequently, policy positions expressed by participating civil servants in this kind of organization are not personal opinions of individuals, but ultimately politically anchored national positions emerging from policy coordination on a national or EU level. The formal regional policy initiatives become parts of the same intergovernmental regulatory continuum through this coordination, instead of being isolated or fragmented parallel regimes.

Other forms of regional work without such formal regulatory outputs, and thus more relaxed policy coordination requirements and procedural rules (e.g. groups of the EU Strategy for the Baltic Sea Region) are naturally influential in other ways, e.g. via distributing project funding as well as generating new ideas and regional consensus.

In the Baltic Sea the formal type of regional intergovernmental bureaucracy on maritime transport matters takes place within the maritime working group of the Helsinki Commission (HELCOM) for ship based pollution issues, including MARPOL and the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWMC) [12], but also elsewhere such as within the Baltic Sea Hydrographic Commission (BSHC) of the International Hydrographic Organization (IHO) in areas such as hydrography and navigational charts.

The HELCOM Maritime working group, previously called "WG 2" (1975–1980), "Maritime Committee" (1980–2000) and "Sea-based pollution group" (2000–2002), is a technical subsidiary HELCOM group, established to advise the main decision making body (the Helsinki Commission) in matters related to pollution from ships. This covers the implementation of what are the 1992 Helsinki Convention Articles 8–12[1] as well as Annexes IV "Prevention of pollution from ships" and VI "Prevention of pollution from offshore activities".

Over the years the HELCOM maritime group has prepared a large number of secondary instruments on various aspects of clean and safe shipping, some of which are mentioned in this article. These include regional Recommendations (based on Helsinki Convention Article X) and other policy documents, as well as relevant sections of declarations of high level meetings.

One important clue to the long term interest of the Baltic Sea coastal states and EU to endorse and actively engage in this kind of regional cooperation around pollution from ships, taking place in parallel to similar work at IMO, can be found in the Annex IV of the Helsinki Convention. It highlights the supporting role of HELCOM in regionally harmonized implementation of IMO treaties in the Baltic Sea. Due to the global focus of IMO work it is not difficult to see the practical need for regional implementation follow up, by sharing best practices and in some cases agreeing on the necessary regional details left open by necessity in global agreements. Since 1980 HELCOM and IMO (at the time called IMCO) have a cooperation agreement in place, granting mutual observer status.

Another motivation for regional cooperation on pollution from ships, and perhaps more significantly, one for the development of international environmental law and policy, is that initiatives for new technical regulations discussed at IMO do not appear from thin air. In many cases the necessary ingredients for a proposal and an eventual decision at IMO emerge from complex and lengthy "pre-negotiations" and technical drafting of proposals carried out at other fora. Especially in Europe [13, p. 84], regional work has been a catalyst for more stringent IMO regulation of pollution from ships globally, as well as regionally via the notion of"special areas" enabled by the International Convention for the Prevention of Pollution from Ships (MARPOL) [14].

This IMO synergy has been facilitated by the fact that, in contrast to some other fields of HELCOM work, the national delegations to the Maritime working group have come [15] mainly from national maritime authorities or their ministries responsible for transport matters. These ministries are where concrete regulation of pollution from ships is prepared nationally. Since the adoption of the revised 1992 Convention on the protection of the marine environment of the Baltic Sea (Helsinki Convention) [5,6] also industry groupings and NGOs, many of which are also active at IMO, have had access to the maritime group as observers and participate actively.

In addition to cooperation within HELCOM maritime group, taking place in advance and in between IMO meetings, regional coordination between coastal countries has also taken place during the meetings of IMO Marine Environment Protection Committee (MEPC). Before 1986 this latter function was provided by an informal group called the "Baltic Club" [e.g. [16, p. 9]] and between 1987 and 2003 an explicit Baltic Sea coordination body called the "Baltic Maritime Coordination Meeting" (BMCM) existed. Until the discontinuation of BMCMs in 2004 [17, p. 8], possibly as an indirect result of EU enlargement, the outcomes of these meetings were presented and discussed at HELCOM Maritime. Today

[1] 8 "Prevention of pollution from ships", 9 "Pleasure craft", 10 "Prohibition of incineration", 11 "Prevention of dumping", 12 "Exploration and exploitation of the seabed and its subsoil".

EU coordination meetings (EU Working Party on Shipping), which take place regularly in advance of IMO and even HELCOM maritime meetings, have similar functions but do not include Russia.

The following three sections provide concrete examples on the interaction and synergy between negotiations taking place within HELCOM and IMO to develop the regulation of pollution from ships in the Baltic Sea.

3. Air pollution (Baltic Sea SECA and NECA)

Compared to topics such as oil and garbage, air (exhaust gas) pollution from ships is a relatively new issue in the global discussions on ship-based pollution. As with many other initiatives for more stringent environmental requirements [13], air pollution from ships emerged in the international arena from Northern Europe. This was via a paragraph aiming to reduce atmospheric pollution[2] inserted to the 1987 Ministerial Declaration of the Second International Conference on the Protection of the North Sea, London, 24–25 November 1987 [18]. Based on the outcome of that meeting a proposal was submitted by Norway to MEPC 26 in 1988, which consequently introduced air pollution from ships to the IMO agenda [19, p. 28].

The rapidly expanding global interest in air pollution during those years is also visible in the records of the HELCOM Maritime Working group. First discussions in 1987 were triggered by a German proposal for a new HELCOM Recommendation on fuel oil quality, referring to the upcoming North Sea conference in London [20, paras 10.5–10.9, Annex 9]. As a result of these discussions air emissions from ships were added to the long term work plan of the group [21, p. 87], where it has remained as a regular topic.

Developments on air pollution from ships in the Baltic Sea evolved rapidly and in 1988 the HELCOM Ministerial Meeting Declaration [22, p. 5] included a general wording on promoting standards of fuel oil quality.[3] The same year the maritime group considered substantial Danish and Swedish submissions on air pollution from ships. A dedicated HELCOM sub-group on reduction of air pollution from ships, HELCOM MC AIR (1988–96) was established, with the aim to consider the issue in more detail and to develop a common approach by the Baltic Sea states to be held at IMO [23, p. 87].

Within the region the work resulted in a compilation of national data on air pollution from ships and by the 1990 adoption of a regional measure to reduce air pollution from ships which was based on the German proposal from 1988 [24]. This first measure aimed at development of quality standards for marine fuel oils (S, Chl and heavy metals), prohibition of adding hazardous waste and applying best available technology (BAT) to reduce NOx and SOx emissions [24].

At IMO the Baltic Sea countries played an active role in developing the entirely new MARPOL Annex on air pollution. The maritime group developed a proposal supporting the reduction of air pollution from ships, submitted by Sweden on behalf of the Baltic Sea countries to IMO MEPC 29 in 1990. Available drafts of the new MARPOL Annex were also discussed and commented regionally within HELCOM MC AIR, in later stages with the participation of e.g. IMO Secretariat and Norway, as part of preparations for IMO discussions [e.g. [25]].

3.1. Baltic Sea SECA

After 1992 it was recognized that stringent global rules were not receiving the necessary support at IMO [19, pp. 32–43] and as a response the Baltic Sea countries developed, within HELCOM MC AIR, a proposal and needed background information for the designation of the Baltic Sea as SOx Emission Control Area (SECA) to supplement the global consensus.

This proposal for a Baltic Sea SECA was presented to IMO in 1994, substantiated with a background document to MEPC 37 in 1995 [26] and further supplemented with a submission to MEPC 39 in 1997 [27] where it was finally adopted as the first Annex VI SECA in the world, limiting sulphur content in fuel to 1,5%. The new MARPOL Annex VI on air pollution, adopted at the same meeting in 1997, entered into force May 2005 with a global cap of 4.5% [19].

After a break in substantial work, HELCOM interest on exhaust gases awakened again with the entry into force of MARPOL Annex VI. For EU countries in the region, which had doubled in number when Poland, Latvia, Lithuania and Estonia joined in 2004, this renewed interest was linked to parallel work on the 2005 EU Sulphur Directive [28].

The Maritime Meeting in 2006 felt that there is a need to tighten the MARPOL SECA emission limits and Germany took the lead in correspondence work [29, p. 7]. The resulting joint input paper to IMO was agreed at the 2007 HELCOM Ministerial Meeting [7][4] with the core message that, based on available data including successful compliance rate in enforcing the 1,5% limit in the Baltic Sea SECA, more ambitious goals were achievable.

The HELCOM document was sent to MEPC 57 in 2008 [30] where it contributed to the result of significantly more stringent global and regional limits for SOx emissions agreed at IMO in 2008 in the context of the revision of Annex VI of MARPOL. The new sulphur limits (0,1% in SECAs and 3,5% globally, latter to become 0,5% in 2020) entered into force in January 2015. By 2016 the implementation of the Baltic Sea SECA area had reduced SOx emissions from ships by more than 90% of the emissions level in 2006 [31].

Even if the core of implementation and enforcement efforts on the SECA rules take place elsewhere (e.g. EU, Paris MoU), the HELCOM maritime group has also provided some input in this follow-up work, the latest example being a correspondence group (CG SECA) led by Sweden in 2014–2016 [32].

3.2. Baltic Sea NECA

In parallel to these developments around SOx emission limits, NOx emissions from ships received renewed attention in the Baltic Sea. There had been some initial discussions on NOx during the MC AIR work in the 1990s, led by Sweden, Finland and Denmark, but it had not received enough support for progress. However, beginning from 2004 the HELCOM maritime group agreed to contribute to efforts at IMO to review the MARPOL emission limits for NOx and the corresponding Technical Code [17, p. 5, 33, p. 5]. Based on a principal decision at the HELCOM Ministerial Meeting in 2007 [7, p. 27] to contribute to the work on NOx measures, an information document was submitted by the Baltic Sea countries to MEPC 57 in 2008 [34].

The maximum allowable phosphorus and nitrogen input levels agreed by the HELCOM Ministerial Meeting in 2007 [7, pp. 8–9] further highlighted the need to address all feasible sources of nutrient pollution to the Baltic Sea, including NOx from ships' exhaust gases. An initiative to designate the Baltic as a NOx emission control area (NECA) emerged from the same meeting [7, p. 27]. As the NECA measure targeted new ships only it was combined with voluntary economic incentives,

[2] "(…) 31. initiate actions, within the appropriate international bodies concerned such as the International Maritime Organization and the International Standards Organization as may be appropriate, leading to improved quality standards of heavy fuels, and actively support this work aimed at reducing marine and atmospheric pollution; (…)".

[3] "(…) Cooperate within appropriate international bodies to promote the development of environmentally sound standards of marine fuels, (…)".

[4] "WE AGREE to support efforts within IMO under the ongoing review process of Annex VI of MARPOL 73/78 to tighten sulphur content in fuel oil at the global level, by having a joint submission to IMO as contained on page 99 by 25 January 2008 prior to MEPC 57 in April 2008, with the aim of addressing also the regional component of the issue".

enabling implementation in advance of regulatory deadlines [35].

In 2008 the maritime group agreed to a NECA designation in principle and established a regional correspondence group led by Finland to prepare the submission [36, p.8], which included a number of studies on the environmental and health benefits as well as costs of a NECA. Finland started annual reporting by the Finnish Meteorological Institute on emissions from shipping in the region [e.g. [31]] based on AIS modeling, which has been an important basis for overall maritime group discussions on airborne emissions. The necessary regional political support was clear by 2011 and by 2012 the NECA submission documents were considered by HELCOM as complete and technically ready for submission, while the only remaining issue was the actual timing of the submission [37, p. 7].

However, Russia remained skeptical to a quick final decision on the NECA and wished to postpone the submission to IMO. Possible motives behind Russia's position include the fact that it had acceded to the MARPOL Annex VI only shortly before, in 2011 [38, p. 170], and the 2016 implementation deadline for NECAs included in MARPOL at the time was relatively close. However, in the other coastal countries the industry was not eager to add to the burden of the SECA implementation, even if the HELCOM study [39] had concluded that the costs of NECA alone would be relatively small.

In terms of technology the NOx emission requirements of NECA were possible to meet using a selective catalytic reduction (SCR) unit, for which cost efficient technology was available [39]. However, implementation of NECAs is also closely linked to the deployment of engine technology using entirely new types of alternative fuels, such as LNG, as well as the development of the related fuel distribution infrastructure. Thus, in some coastal countries there were prospects that the costs of a NECA on maritime industry would be balanced by profit prospects for providers of new clean technologies (e.g. Wärtsilä in Finland and MAN Diesel in Germany) and by providing advantage for environmentally progressive ship owners (e.g. Maersk in Denmark). For others this NECA incentive was weaker.

In order to clarify the remaining issues behind the Russian position, a HELCOM stakeholder conference on NECA was organized in 2013 [40, p. 2]. At MEPC 65, held the same year it was proposed to postpone the implementation date of future new MARPOL Annex VI NECAs from 2016 to 2021. Despite this adjustment, Russia could not agree on a concrete date for the NECA submission during the HELCOM Ministerial Meeting in 2013 [41, p. 6]. At MEPC 66 in 2014 the final IMO agreement was to leave the implementation dates to be agreed case by case [42].

Based on an initiative by Denmark the Maritime group agreed in 2014 to work on a roadmap on NECA [43, p. 8] with Denmark, and later also Finland, as lead. This proposal was based on the parallel developments in the North Sea countries for a North Sea NECA [43, p. 8]. Synergy between the two initiatives was further developed in joint technical meetings in 2015, in Oslo February 2015 and in Helsinki June 2015. A final NECA roadmap was agreed in 2016 [44] with the content that the NECA application would be submitted to MEPC 70 in 2016, together with a parallel application from the North Sea, and that the effective implementation date would be set as 1.1.2021 [45]. Besides the expanded geographic scope a possible facilitating factor in the negotiations was the parallel Russian LNG infrastructure developments, picking up in the Baltic Sea.

Technical adjustments to the Baltic Sea NECA application were made at meetings in Copenhagen April 2016 and St. Petersburg May 2016 [45, p. 4]. The final form and decision on the submission of the Baltic Sea NECA application to IMO MEPC 70 was made at the HELCOM HOD meeting in June 2016 [45, p. 4]. The proposal was submitted and agreed by MEPC 70 in October 2016 together with a similar application from the North Sea [46, p. 38]. Final revisions to MARPOL, with NECA status for the Baltic Sea and the North Sea, were made in July 2017 at MEPC 71.

The 2016 IMO decision on the Baltic Sea NECA means that new ships, built 2021 or later, and sailing in the Baltic and the North Sea NECAs, have to meet the Tier III standards of MARPOL Annex VI. This corresponds to approximately 70% reduction in NOx emissions compared to current (Tier II) levels and can be achieved by technologies such as SCR or using liquefied natural gas (LNG) as a fuel.

As NECA targets only new ships the effects to overall emissions will be more gradual compared to those of SECA, but nevertheless significant in the long term. The European Monitoring and Evaluation Programme (EMEP) has provided estimates to HELCOM based on published NECA scenarios [47]. These indicate that after two decades of enforcement the reduction in total nitrogen deposition to the Baltic Sea region will be in the order of 22,000 t annually as a combined effect of the Baltic and North Seas NECAs, including reductions of 7000 t from deposition directly to sea and 15,000 t to the catchment area [48].

As described above, the final stages of the regional NECA negotiations, and the hesitation from Russia, was largely dominated by discussions on the availability of technology. For this reason HELCOM established a dedicated follow-up group GREEN TEAM (2014-) [43, p. 6], based on a public-private partnership model, to catalyze the use of green ship technology and fuels in the Baltic Sea to be a key regional implementation process in relation to the Baltic Sea NECA. In 2017 a revision of the HELCOM Recommendation on voluntary economic incentives was launched within this initiative as a first concrete step [49, p. 3].

4. Sewage from passenger ships

Global interest in regulating sewage from ships has been relatively low, as an example MARPOL Annex IV on sewage entered into force only in 2003, 25 years from its 1978 inclusion to the convention [38]. However, in the Baltic, sewage from ships – whether commercial or pleasure craft – is one of the classical topics on which the HELCOM maritime group has invested considerable efforts on since the first meeting in 1975.

While sewage from ships or other vessels is not, and has never been, among the most important nutrient pollution sources in the Baltic region, it is still responsible for inputs comparable to a larger city [4]. It also an issue of public concern due to its sanitary, but likely also symbolic, dimensions. Further, in the Baltic Sea region it has always been considered against the background of tightening sewage treatment requirements from land based sources, and scattered settlements [e.g. [50]].

Addressing sewage from ships is closely linked to ensuring the availability of port reception facilities for sewage, as well as the use of these facilities by visiting ships. Within HELCOM maritime the work on reception facilities, including those for sewage, has for this reason been a key area of regional work. A booklet providing an overview of port reception facilities in the region was published in 1979 and the first recommendations addressing port reception of wastes from ships, including sewage, were adopted in 1980 [51].

Port reception of sewage depends on both ports, making facilities available, and on passenger ship operators, making decisions on their use. Ports, ship operators as well as national authorities developed a close cooperation early and also enabled substantial progress on a voluntary basis. As an example, the shipping companies Silja Line and Viking Line, with regular service between Finland and Sweden, had dedicated delivery facilities in place during the 1980s (Turku: Silja 1984, Viking 1988 and Stockholm: Silja 1985, Viking 1987) [52, p. 78].

Even if mainly focusing on oil waste, a dedicated HELCOM expert group (MC REFAC) worked 1988–95 and drafted the Baltic Sea Strategy on Port Reception Facilities which was linked to a series of concrete infrastructure projects in former east bloc countries [53, p. 13]. Further, the adoption of the “No Special Fee”, or 100% indirect fee, as the recommended regional approach to waste fees in ports in 1998 [54] aimed to remove remaining disincentives to use of the available facilities. The HELCOM “no special fee” approach was later used as a model

during the drafting of the EU Directive on port reception facilities [55]. Regional and national studies on passenger traffic as well as the availability and use of facilities provided the necessary facts [e.g. [56]].

This long–term work on port reception took place in parallel to regional developments around on-board treatment, even though there was less maneuvering space due to the strong IMO mandate on equipment standards. The first regional guidelines on type approval and testing of sewage treatment plants were approved in 1980 [57]. The coastal countries also agreed on regional measures restricting sewage discharges in the territorial sea [e.g. [5]].

However, addressing discharges beyond national waters required work at IMO on MARPOL and its Annex IV. Even if the idea of a MARPOL Annex IV special area in the Baltic was raised relatively early, e.g. by Poland in 1993 [58], it did not receive the necessary support until the entry into force of MARPOL Annex IV in 2003 and a parallel increase in the number of large cruise ships visiting Baltic Sea ports.

In 2006, as a response to the public debate in some Contracting Parties, especially Finland, the HELCOM Maritime group established a correspondence group led by Finland to consider amendments to MARPOL Annex IV. This included amendments to introduce the notion of special areas to the Annex, where more stringent regulations on discharges of sewage from ships would be applied, and designate the Baltic Sea as such [29, p. 8].

After two years of preparatory work, including completion of a study funded by Finland [59], HELCOM agreed to the initiative at the Ministerial Meeting in 2007 [7, p. 26] and a proposal banning untreated sewage discharges at sea and requiring delivery to port reception facility, or alternatively on-board treatment with nutrient removal, was subsequently drafted and agreed within HELCOM in 2009 [60, p. 6]. The proposal was submitted to IMO MEPC 60 [61–63] with requested supplementary information provided to IMO MEPC 61 [64]. The final IMO approval of the Baltic Sea special area was given at MEPC 62 in 2011 [65].

This Baltic initiative changed the entire global regulatory framework on sewage from passenger ships as before the 2011 decisions neither MARPOL nor other international law did not provide a basis for establishment of such special areas beyond territorial waters anywhere in the world.

According to the IMO decision in 2011 a prerequisite of the effective enforcement of the Annex IV special area was the provision of adequate port reception facilities, which was to be notified separately [65]. Even if all major ports indicated the availability of sewage facilities in the IMO GISIS by 2010 the cruise industry questioned the adequacy of the facilities, especially in smaller ports, relying mainly on sewage trucks.

In order to pave way for entry into force of the new rules, HELCOM established a new type of public–private forum in 2010, the HELCOM Cooperation Platform on sewage Port Reception Facilities (CP PRF, 2010-) to provide an overview of the situation in the region and share best practices [66, p. 8]. Importantly this cooperation has included partnerships with industry, both ports (BPO & ESPO) as well as ship owners/operators (CLIA and Interferry), and the World Wildlife Fund (WWF).

Between 2010 and 2015 the coastal countries, ports and the industry used the HELCOM platform and other meetings to find common ground around adequacy of the needed facilities [67]. HELCOM compiled information on the status, and use, of the facilities in cooperation with CLIA and WWF [68].

By 2015 an agreement was reached within a HELCOM correspondence group led by Sweden that the effective dates for the special area should be 2021 for existing ships, and 2019 for new ships. At MEPC 68 the same year all Baltic Sea coastal countries (except Russia) notified IMO that the sewage port reception facilities in their ports were adequate. During MEPC 69 in April 2016 Russia notified adequacy to IMO, as a response to a submission from Sweden, and the meeting subsequently agreed to the entry into force of the Baltic Sea Special Area in MARPOL Annex IV with the proposed effective dates, 2019 for new ships and 2021 for existing ships [69]. On the request of Russia an extension was introduced for ships on direct route between the North Sea and the St. Petersburg area until 2023 [69].

The 2016 decision at IMO means that sewage discharges to the Baltic Sea will be only allowed after advanced on-board wastewater treatment, which will practically stop sewage pollution from passenger ships in the region by 2021. As a key follow–up component HELCOM has agreed to continue its work within the Cooperation Platform to improve the facilities in the region until the effective dates and beyond [70, p. 6].

5. Ballast water management

Another current topic is ballast water of ships -an important carrier of harmful aquatic alien species globally and in the Baltic Sea. The issue of unwanted marine organisms carried in ships ballast waters was raised for the first time at the IMO in 1988 (MEPC 26) by Canada, US and Australia. As a result IMO drafted the first guidelines adopted in 1991 [71], established a ballast water working group in 1992 and the work eventually led to the adoption of the IMO BWMC in 2004 [12], which entered into force in 2017.

As in other marine regions, ballast water is one of the main pathways of non-indigenous species introductions to the Baltic Sea [72,73] which was recognized by the scientific community in the region already by the end of 1980s [74].

The HELCOM maritime working group considered ballast water as a pathway for species introductions for the first time in 1993. However, the coastal administrations refrained from regional measures and preferred to discuss the matter at IMO, where many provided active input [74]. Instead, during the 1990s the regional work focused on providing the necessary scientific background, with regional studies on introductions and related risk assessments [74]. Scientific work, including monitoring and assessment of introductions of non-native species has remained a core part of HELCOM activities in this field [72].

During the early 2000s, a series of regional workshops on ballast water introductions were organized (IMO 2001, NCM 2002 & BSRC/HELCOM/COLAR 2005) [74]. These, and subsequent work within the HELCOM maritime group, resulted in a draft HELCOM recommendation on Ballast water [17]. However, the Recommendation was rejected by the HELCOM Heads of Delegations (HODs), likely due to the fear of interference with IMO work. Its key contents were nevertheless adopted in 2007 as a regional roadmap for the ratification of the BWMC [7, p. 97].

Despite the early reluctance of regulatory work within HELCOM on ballast water, Article 13 of the IMO BWMC explicitly encourages work within regional agreements to develop “harmonized procedures” [12]. Within HELCOM maritime working group such efforts of regional harmonization have been pursued since 2004 in two main strands: ballast water exchange, as well as exemptions to the ballast water treatment provisions of BWMC.

5.1. Ballast water exchange

As early stages in the implementation of the BWMC rely on ballast water exchange, the first task was to consider how to deal with ballast water exchange in the Baltic Sea. The requirements of depth and distance from the shore for exchange as specified in BWMC (Regulation B-4) cannot be met in the Baltic Sea. Further, as most of the alien species in the region have a wide tolerance in salinity HELCOM made a decision that no ballast water exchange areas would be designated in the region [33]. For the purposes of oceanic voyages with a Baltic Sea destination, HELCOM also drafted three interim voluntary guidance documents jointly with corresponding organizations in the North-East Atlantic (OSPAR) and the Mediterranean (REMPEC), circulated as IMO Circulars [75–77].

5.2. Risk assessments for BWMC exemptions

On the topic of harmonized implementation of BWMC regulation A-4 on exemptions, which rely on risk assessments, a series of HELCOM studies on ballast water risk assessments (called ALIENS 1, 2 & 3) was initiated after the signature of the BWMC 2004. In 2010 a HELCOM guideline on exemptions was adopted based on these studies [78].

As the next step this, and similar work in the North Sea region, led to the drafting of a joint HELCOM-OSPAR regional procedure to the implementation of A-4 exemptions under the lead of Germany which was adopted by the two organizations in 2013 [79]. This joint regional agreement on risk assessments, i.e. definitions of low risk routes eligible for exemptions, comprises a fairly complex system consisting of a risk assessment algorithm, a list of especially harmful target species, a common sampling protocol (to ensure comparability of information), the relevant administrative procedures as well as a website [80] to provide an user interface.

The regional procedure aims to smooth the way for BWMC ratification in the two regions and provide for transparent and harmonized implementation of exemptions for the benefit of the Baltic Sea marine environment but also for ship owners and operators [79]. Some countries, including Norway, have included direct references to the HELCOM-OSPAR exemption procedure in their national legislation on ballast water management.

The joint procedure continues to evolve in parallel to experience gained in its use. As an example, Denmark has raised both within HELCOM and IMO, its preference to have larger "Same Risk" areas eligible for exemptions, instead of focusing on separate risk assessments for routes between individual ports.

As mentioned above, the last decade of regional implementation of BWMC in the Baltic Sea and within HELCOM is characterized by a close cooperation with the OSPAR Commission for the protection of the North-East Atlantic. Besides the three ballast water exchange guidelines and the joint (HELCOM-OSPAR) harmonized procedure this includes the joint intergovernmental task group on exemptions (TG BALLAST 2012-), in which also industry participants have been very active.

In line with a regional agreement at HELCOM, Denmark, Estonia, Finland, Germany, Lithuania, Russia and Sweden have ratified or acceded the BWMC by 2018. Poland and Latvia, the remaining two Baltic Sea coastal countries, are in different stages of the ratification process [4]. The 2016 ratification of Finland carried extra political stakes as it triggered the international entry into force of the BWMC as a whole.

6. Synthesis

6.1. Preparation of IMO proposals at HELCOM

As described in the three examples, since the 1990s the HELCOM maritime group has directly prepared three successful proposals to IMO on MARPOL special area measures in the Baltic Sea (Table 1). These include two on reducing exhaust gas emissions from ships (MARPOL Annex VI, SECA 1997 & NECA 2016) as well as one on amending MARPOL Annex IV to include the concept of a special area and designating the Baltic Sea as such. In the relation to BWMC, substantial work within HELCOM started only after the conclusion of the treaty in 2004 but has nevertheless been fairly productive, even if the output has been softer in nature. Results include conclusions on regional application of BWMC ballast water exchange (Standard D-1) and granting of exemptions (Regulation A-4) (Table 1).

A common feature of these new rules is that they have been the result of persistent long term work. In the case of MARPOL special areas the preparatory processes have lasted in the order of ten years from official launch of drafting to final IMO decision (Table 1), much longer if the preceding exchange of scientific results would be included.

While the HELCOM secretariat has provided its facilitating services for this work, it is clear that the key actors behind the described

Table 1
IMO related work at HELCOM in the fields of air pollution, sewage and ballast water with timeframes, targeted bodies and lead countries. Abbreviations: volu. = voluntary guideline, appr. = approval, subm. = submission, Eff. = Effective. BW exch. I = Ballast Water exchange guideline I [75], BW exch. II = Ballast Water exchange guideline II (IMO 2009), BW exch. III = Ballast Water exchange guideline III [77], BS + NEA A-4 exemptions = HELCOM–OSPAR joint harmonized procedure on A-4 exemptions [79], CG = Correspondence Group, MC = Maritime Committee (old name for the HELCOM maritime working group), TG = Task Group.

Issue	Start	appr. HELCOM	subm. IMO	appr. IMO	Eff. dates	Drafting body HELCOM	Lead countries Preparations	Follow up body	Follow up topic	Lead countries Follow-up
BS SECA (MARPOL ANNEX VI)	1987	1994	1994	1997	2005	MC AIR	Sweden Germany	CGs incl. CG SECA 2014–16	Revisions, Information & best practices	Germany Sweden
BS NECA (MARPOL ANNEX VI)	2007	2016	2016	2016	2021	CG NECA	Finland Denmark	GREEN TEAM	Information & best practices (technology incl alternative fuels)	Finland Sweden
BS SA (MARPOL ANNEX IV)	2006	2010 2016	2010	2016 (2011)	2019/2021/ 2023	CG	Finland Sweden	CP PRF	Information & best practices (PRFs)	Germany Sweden
BW exch. I (BWMC)	2007	2008	2008	2008 (volu.)	2008	MARITIME	Germany	(MARITIME)	dissemination	–
BW exch. II (BWMC)	2007	2009	2009	2009 (volu.)	2009	MARITIME	Germany	(MARITIME)	dissemination	–
BW exch. III (BWMC)	2010	2011	2012	2012 (volu.)	2012	MARITIME	Germany	(MARITIME)	dissemination	–
BS + NEA A-4 exemptions (BWMC)	2012	2013	–	–	(2013)	HELCOM-OSPAR TG BALLAST	Germany	HELCOM-OSPAR TG BALLAST	Further develop A-4 exemption approach	Germany Sweden

processes are the national administrations and their civil servants leading the processes (Table 1). Even if many delegations have been active, the most active national administrations in leading roles at HELCOM have been (in alphabetic order) Denmark, Finland, Germany and Sweden (Table 1).

The national administrations have also ensured the essential synergy with IMO, facilitated by the fact that the same organizations, in some cases even the same persons, attending the HELCOM maritime group have also been representing their countries at the relevant IMO bodies, especially the IMO Marine Environment Protection Committee (MEPC). As a large majority of national delegations in HELCOM maritime group represent different ministries than those attending the decision making bodies (Heads of Delegations or HOD) these processes are also successes of inter-ministerial consultations within countries, in other words cross sectorial cooperation.

The involvement and activity of industry observers within HELCOM has also been a key factor in preparatory successes, but also in implementation. This involvement has expanded over the years and the IMO-related initiatives have drawn several new stakeholders to regional work. One example is the Cruise Lines International Association (CLIA), which contributed substantially to the regional process on the MARPOL Annex IV special area on sewage from passenger ships.

6.2. Implementation and follow-up

There are weaker incentives to regional cooperation on implementation when compared to preparation, as the former is a national responsibility. Regional cooperation on implementation is nevertheless a necessary component in maintaining the credibility of the claims made during the introduction of the issue to the IMO arena.

As enforcement is more tightly in the hands of national (and EU) structures, the substance of implementation follow up on the regional level is usually simply to share information and best practices (Table 1). In addition, HELCOM has made increasing efforts to catalyze public-private interaction as part of soft means to facilitate, and even fast-forward, implementation of IMO regulations. Examples include the HELCOM cooperation platforms on port reception facilities (2010-) and green technology and alternative fuels (2014-), which are part of implementation efforts of Baltic Sea special areas in Annex IV and Annex VI of MARPOL, respectively.

In the case of BWMC regional implementation work has also included concrete development of harmonized regional approaches. This exception is likely related to the fact that this kind of regional harmonization is explicitly requested by Article 14 of the BWMC treaty, but also because the group of experts with the needed substantial knowledge on the issue is small.

6.3. Interaction with other bodies beyond IMO

Due to the network nature of international cooperation and the long processes involved it is likely impossible to comprehensively describe how the participating countries have used different organizations to reach the final decisions described in this article. The same national administrations have also used other venues beyond HELCOM, including the EU system but also other opportunities, to refine the necessary documents and create the necessary support in countries beyond the region.

Particularly in the field of enforcement, but also in preparatory negotiations, the role of the European Union has grown in importance during the last decades for environmental regulation of shipping in the Baltic Sea region. After all, eight out of the nine coastal countries are also members and the EU itself has ratified the Helsinki Convention and participates actively in its work. Even if EU is not a signatory of IMO instruments such as MARPOL there is EU competence in many marine transport related issues (e.g. SOx and port reception facilities) as a result of European legislation. This has led to requirements of coordination among EU Member States, which has facilitated adoption at IMO level due to the number of EU members voting according to the coordinated position.

The need of proper follow-up of the described processes has also been highlighted by the coastal countries in the wider global framework, particularly the UN general assembly work on the Sustainable Development Goals (SDGs). At the UN Oceans conference of 2017 Baltic Sea NECA implementation, including the work of the HELCOM cooperation platform on green technology and alternative fuels, was submitted as a regional contribution to reach the overall aims of SDG 14, focusing on the marine environment.

6.4. Three dimensions of cooperation

Besides the procedural themes of preparation and implementation, three distinct dimensions of cooperation can be identified from the case studies. The first dimension (horizontal) is that of work across the different national and EU administrations, particularly environment and transport. The second dimension (vertical) is the essential cooperation and synergy across different geographic scales of governance -from global (IMO), European (EU) to regional (HELCOM) to the national administrations. The third dimension (public-private-civil society) is cooperation between public administrations, industry as well as NGOs, and also ephemeral groupings like projects, which has clearly matured over the last three decades.

6.5. Role of the 2007 Baltic Sea Action Plan

The described processes also show the practical function of ministerial meeting outcomes, particularly the HELCOM Baltic Sea Action Plan (BSAP) and particularly its overall policy goal of a good status of the Baltic Sea marine environment by 2021. The implementation date of 2021 included in both NECA and the sewage special area come from this source. All of the mentioned IMO initiatives were also specifically addressed, and developed by the BSAP [7] and its follow-up.

The BSAP was drafted as a regional pilot for the emerging EU Marine Strategy Directive (EU) and is based on the Ecosystem Approach concept, which (in the HELCOM context) includes a focus on scientific indicators [8]. The elaborate and quantitative Baltic Sea reduction scheme for nutrient pollution, a key innovative feature of BSAP [8], has also provided the underlying rationale for reducing inputs of NOx and sewage (containing nitrogen and phosphorus) from ships which was also referred to in the IMO submissions.

7. Conclusions

As described in this paper HELCOM work during the last decades has been the source of several concrete and successful regulatory proposals to IMO on reducing pollution from ships in the Baltic Sea, implementation of which have also been followed-up regionally. In terms of concrete pollution reduction these described initiatives have, or are estimated to, reduce SOx emissions from ships in the region by ca. 90% by 2015 (SECA), NOx emissions from new ships built 2021 and later by ca. 70% (NECA), by 2021 stop insufficiently treated sewage discharges from practically all passenger vessels in the region (Special Area MARPOL Annex IV) and non-quantified effects on alien species introductions via ballast water.

Thus, while HELCOM initiatives on concrete measures in some other fields of human activity, particularly fisheries and agriculture, have in the past been somewhat difficult even to discuss, environmental issues related to maritime traffic have not only been discussed but also effectively regulated via IMO.

Besides utilizing synergies between organizations working at different geographic scales of governance (HELCOM, IMO but also others such as the EU), the coastal countries and the EU have achieved these results via persistent long term work involving close cooperation

between different national administrations (transport and environment) as well as between national administrations and private sector/NGOs. Outcomes of Ministerial Meetings, especially the 2007 BSAP, have provided milestones, momentum and an overall framework including timeframes.

The indirect use of the IMO regulatory framework for ship-based pollution by the HELCOM community has been a long term innovative feature, which also bypasses the enforcement concerns which are sometimes highlighted around purely regional rules. The strong link to IMO work based on the Annex IV of the Helsinki Convention has also to a large degree avoided a separate and parallel regional HELCOM regime. Indirectly, or even directly in the case of the MARPOL Annex IV, the described initiatives developed in the region have also developed environmental regulation of shipping globally. It can thus be even argued that IMO has in this way been strengthened as an organization by regional work within HELCOM.

The kind of synergies between regional seas organizations and IMO described in this article could well be successful in other regions of the world. Even if the HELCOM cooperation on pollution from ships has been facilitated by an, relatively rare, explicit legal mandate on pollution from ships, similar regional work could likely be carried out under the more general provisions of a regional agreement or similar instrument.

The key ingredient for success in the field of pollution from ships is support and direct involvement of the national authorities responsible for environmental matters at IMO. Since the beginning in the 1970s the maritime authorities of the Baltic Sea countries have been supportive to, if not driving, the strong shipping dimension to the HELCOM regional cooperation. A likely incentive and original motive for the national administrations is the practical need for a regional cooperation and coordination platform on sea based pollution, including the need to ensure the efficient implementation of existing, and regional coordination of new, IMO initiatives. The existence of a permanent regional forum and regular meetings of the HELCOM maritime working group in the Baltic Sea has likely lowered the threshold to initiate and develop regional proposals to IMO.

As described in this article, this kind regional cooperation on IMO matters can be carried out in many different ways and with various organizational arrangements, also in the Baltic Sea. Even if the Helsinki Convention continues to provide a formal incentive, the HELCOM maritime group will continue meaningful substantial work only as long as the Contracting Parties, particularly the competent authorities of the Contracting Parties, find it as a useful arena. This fact calls for constant renewal of the forms of cooperation and agenda setting to cater for the needs of the HELCOM members, namely the coastal states and the EU, and its observers.

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Ecosystem Approach implementation by the Baltic Marine Environment Protection Commission (HELCOM) 2003-2018 measured as meeting time

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Abstract

The Ecosystem Approach is a widely cited concept in the environmental management of oceans and seas, but its actual substance remains indeterminate and complex. Its implementation in the regional intergovernmental work of the Baltic Marine Environment Protection Commission (HELCOM) 2003-2018 is studied as a concrete example for possible insights on its characteristics and practical meaning. A quantitative dataset on meetings with times, topics, and participation of every recorded HELCOM meeting (n=933) during 2003-2018 was compiled to study time use in the organization. Another dataset on all 383 documents adopted/endorsed by the decision-making bodies was compiled to study the evolution of organizational output. The use of the ecosystem approach in high-level meetings outcomes was studied in detail. The material indicates that the volume of HELCOM work measured as person-hours in meetings has doubled in parallel to the process of implementing the Ecosystem Approach, but also EU directives. In addition to a general increase across all fields of work, the main increase comes from new groups in the fields of fisheries, MSP, and agriculture, as well as those on scientific assessments of pollution loads. Simultaneously, the point of gravity of organizational output has shifted away from traditional technical measures and more toward assessments and indicators. The characteristics of the Ecosystem Approach as implemented within HELCOM is related to the programmatic approach of the EU, relying on targets of environmental quality, flexibility on choices of measures to reach these targets as well as policy integration in the form of increased dialogue.

Keywords: ecosystem approach, ecosystem-based management, Regional Seas, MSFD, measures

Introduction

The Ecosystem Approach refers to a group of closely related management concepts with a complex lineage and overlapping terminology (e.g. Ecosystem Approach, Ecosystem Management and Ecosystem Based Management) which, especially since the 1990s, have been widely referred to in environmental law and policy (De Lucia, 2019; Platjouw, 2016). Specifically, the Ecosystem Approach has been a widely invoked concept in the management of human impacts on the world's marine and freshwater ecosystems (Kidd et al., 2011; Langlet and Rayfuse, 2019; Long, 2012; McLeod and Leslie, 2009; Rice et al., 2005; Sherman and Duda, 1999; UNEP, 2013). Since 2003 the ecosystem approach has also been a central concept in the regional intergovernmental work of the Baltic Marine Environment Protection Commission (HELCOM) (JMM, 2003a), a regional seas organization with the task to improve the state of the Baltic Sea marine environment, and the specific context of this article.

Despite this widespread adoption, the general normative and substantial content of the ecosystem approach remains in an abstract state, typical for "twilight" norms (Beyerlin, 2007) frequently used in international environmental law (Haas, 2007). The initial HELCOM definition (JMM, 2003b), providing only a general vision and less guidance on practical implementation, is a fairly typical example. Recent research has made efforts to sharpen the image at least from the theoretical point of view by synthesising the legal (De Lucia, 2019; Langlet and Rayfuse, 2019; Platjouw, 2016), policy (Kidd et al., 2011; McLeod and Leslie, 2009) and scientific (Borja et al., 2016) dimensions of the concept. Additional studies on implementation efforts, providing pragmatic views, lessons learned as well as clues on the practical value of the various themes of the concept in specific contexts, would be valuable for further progress (Sander, 2018).

Studies by others have indicated that implementation of the ecosystem approach within the HELCOM context has led to a change on the conceptual level of organizational language (including e.g. the terminology used) (Valman, 2014) and holistic management agenda (Hassler et al., 2013; Söderström, 2017; Valman, 2014), as well as in terms of work on environmental quality standards and assessments (Bohman, 2018, 2017) and regionalization of EU commitments (Bohman, 2018; Hassler et al., 2013; Hegland et al., 2015; Ringbom and Joas, 2018; Söderström, 2017). as a positive element Bohman also highlights the managerial compliance created by the boundary work on HELCOM quality standards and related assessments (Bohman, 2018) while at the same time joins Ringbom & Joas (2018) and Hassler et al. (2013) in pointing out the risks of replacing specific technical rules with goal oriented approaches.

In contrast, these studies seem to be less convinced that the ecosystem approach implementation has led to deeper institutional changes within HELCOM (Hassler et al., 2013; Hegland et al., 2015; Söderström, 2017; Valman, 2014) or in fully functional cross-sectoral cooperation and stakeholder involvement (Hassler et al., 2013; Hegland et al., 2015; Söderström, 2017).

This article aims to build further on the above studies and contribute with new insights on the characteristics and practical meaning of the Ecosystem Approach concept by studying a 15-year process of practical implementation and concept evolution in the specific intergovernmental context of HELCOM. As material this study uses metadata generated from records of all HELCOM meetings organised 2003-2018, including inferred topics, attendance and meeting length extracted from official meeting records, the content of documents agreed or endorsed by HELCOM decision-making bodies as well as in-depth reviews of key documents informed by practical first-hand experience of the author.

Material and Methods

One of the central aims of this research is to take a closer look at how the work of HELCOM has changed in 2003-2018, a 15-year period after the 2003 adoption of ecosystem approach as a guiding principle for the organization. In this study this "HELCOM work" is studied based on the records available from the HELCOM archives. These records include the reports of meetings and events organized (including content but also information on duration, group names and participation), documents considered by these meetings as well as decisions taken by these meetings. A conceptual overview of the HELCOM work, and its relationship to the research material is presented in Figure 1.

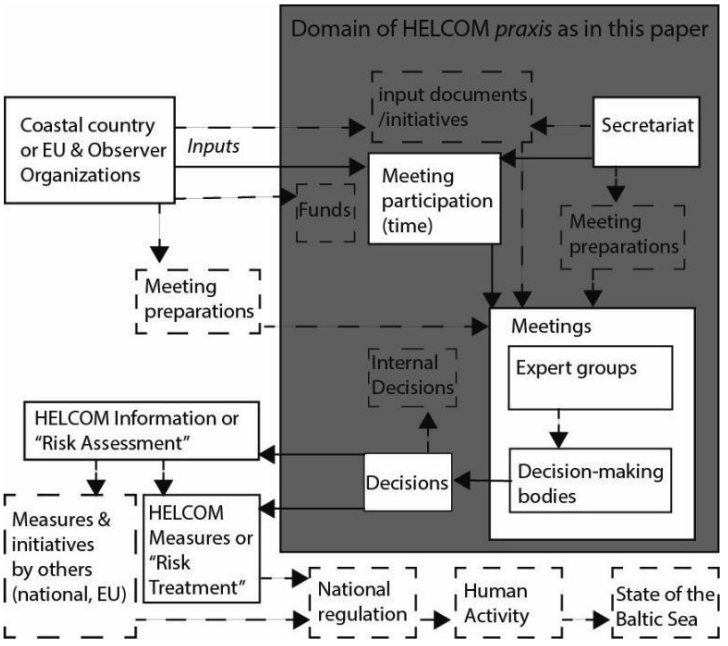

Figure 1*: A conceptual overview of HELCOM work, as well as the surrounding context. The research material available and utilized in this study is presented with continuous arrows and box outlines. This includes meetings, meeting participation as well as decisions by the HELCOM decision making bodies (Helsinki Commission annual meetings, meetings of the Heads of Delegation as well as Ministerial Meetings) as well as related documents. The aspects of HELCOM cooperation which were not systematically covered by this study are depicted with dashed arrows and box outlines.*

The studied material cover changes in invested resources, which could be called *inputs,* during 2003-2018. Even if resources are more commonly studied in terms of money and budgets, this study uses *time* as the focus parameter for measuring resource input. Specifically, the focus parameter is hours of meeting time invested by coastal countries, observers, and the secretariat to HELCOM work.

The time spent by participating persons in HELCOM meetings is proposed as a studied quantity partly due to practical reasons. Reliable records of meeting this time investment are readily available as part of the available meeting records for the whole studied period. However, the quantity is also proposed with the conviction that the indirect investment in terms of expert working time, allocated to HELCOM meetings and preparatory work, is a very significant contribution the contracting parties and observers are making to the practical work of the organization. While some information on direct monetary contributions do exist, primarily in terms of the annual fees of HELCOM contracting parties (in the order of euro 185.000 per coastal country in 2018), these capture only running secretariat costs which represent only a share of the human resources needed and invested. Further, as time investment by countries is possibly also related to political interest it has value beyond the practical dimension. Finally, based on my own practical experience, these meetings are neither a form of displacement activity, at least not at the general level discussed in this thesis, but represent real efforts by the participants to create regional understanding and agreements on the matters under discussion.

In addition to such essentially empiric data, providing clues on what has been the evolution of HELCOM work in terms of actual meetings, the official formulations of, and references to, the ecosystem approach are also available. These provide complementary information on the evolution of theoretical understanding and implementation priorities within the organization.

Material

The core research material of this paper consists of the official meeting records of the Helsinki Commission (HELCOM), out of which three sets of research material were extracted to study the characteristics and evolution of HELCOM work during the 2003-2018 implementation of the ecosystem approach concept.

The first set of research material was an expertise-based extraction of general developments and key aspects of HELCOM ecosystem approach from ministerial meeting outcomes during 2003-2018, thus providing overall information on the evolution of the concept.

The second set of research material was a comprehensive quantitative (meta-) dataset covering meeting topic, attendance as well as start and end times of all the 933 HELCOM meetings which took place during 2003-2018 and have records or mentions in the official or internal archives. This material enabled to study how the HELCOM meeting machinery has evolved, with possible influence from the implementation of the ecosystem approach.

The third set of research material was a compilation of all documents which have been referred to as adopted, endorsed or similarly agreed by the decision-making bodies (Helsinki Commission annual meeting as well as the HELCOM Heads of Delegation) during 2003-2018, enabling study of what kind of output the regional cooperation produced during the period.

The temporal coverage of the material (2003-2018) was determined by both research interests as well as practical limitations. The starting year includes the 2003 adoption of the “Ecosystem Approach” as a key principle guiding HELCOM work.

More details on the methodology utilized and subjective choices taken are described below. When necessary, this extracted data was supplemented with additional document searches which are referred to separately in subsequent text.

I. Outcomes of HELCOM Ministerial Meetings 2003-2018

Declarations of Ministerial Meetings were compiled and studied in detail as they were assumed to reflect the regional consensus on HELCOM ecosystem approach and thus provide a good starting point to observe the evolution of the formal expressions of the institutional understanding of the ecosystem approach. These high-level documents are all results of lengthy drafting processes, often a year or more, and involving extensive national consultations commonly between different ministries. The final outcomes ("Declarations") of HELCOM Ministerial Meetings 2003-2018, namely those of 2003 (Bremen, two meetings), 2007 (Cracow), 2010 (Moscow), 2013 (Copenhagen) and 2018 (Brussels) were thus compiled into a smaller subset of adopted/endorsed documents.

The Declarations of the ministerial meetings and the identified additional documents were studied for direct and indirect references to the ecosystem approach and the core findings were summarised to a table using qualitative judgement (Table 1).

II. Metadata on HELCOM meetings 2003-2018

In order to measure *input* in terms of time invested by participants in HELCOM meetings as well as the thematic focus of the meetings, a comprehensive quantitative metadata covering all the documented HELCOM meetings convening during 2003-2018 was extracted from the official HELCOM meeting records. The aim was to enable a more detailed presentation and study of the evolution of the entire HELCOM meeting machinery during the studied period, including changes in the numbers of meetings, absolute and relative participation of different actors as well as meeting topics.

As the first step, an initial list of meeting names, acronyms, start and end dates as well as venue of all available HELCOM meetings 2003-2018 was compiled. For the years 2014-2018 the starting point for compilation of meetings was a list called "Meetings in the HELCOM framework" which is included in the administrative annex of annual activities reports submitted

by the Secretariat to the meetings of the Helsinki Commission. Such lists were not available in the annual reports from the years 2003-2013. For these years, the initial list of meetings had to be reconstructed manually from another section of the same administrative annex, which specified the participation of Secretariat staff in HELCOM meetings on a person-by-person basis. The resulting draft list was cross-checked and complemented by information included in another category of documents, HELCOM meetings and exercises, which have been regularly submitted to the Heads of Delegation (HOD) meetings and contain names and dates of upcoming events.

As the second step, three types of meeting documents: outcomes, invitations and (annotated) agendas were retrieved for each of the individual meetings included in the initial list of HELCOM meetings. These documents were saved as weblinks (when available online) or as locally stored files. For the years 2014-2018 these documents were mainly extracted from the online HELCOM document handling system active during the time of writing (Sharepoint). For the years preceding 2014, some additional documents were available online via a separate HELCOM online archive based on a legacy system. The remaining documents were retrieved as locally stored digital files by onsite archive searches of the Secretariat internal working server, carried out onsite at the HELCOM Secretariat premises in Helsinki. To ensure completeness of the dataset, the meeting archives of the HELCOM internal server were searched systematically until no new meeting records were found.

During this second phase of work the initial draft list of all HELCOM meetings was complemented with documentation from all meetings which were found but not included in the initial draft list. One exception was outcomes of a few “e-meetings” which refer to time limited written chats organised on dedicated forums at the HELCOM website. After the entire process, including a careful study of every available meeting record in the HELCOM online archives as well as at the Secretariat, the list of HELCOM

meetings was considered as complete, and included a list of 1143 individual meetings (c.f. Supplementary information File 1).

As the third step, a list of HELCOM meetings *sensu stricto* was filtered from the above list of all HELCOM affiliated meetings. This was necessary as the compiled long list of all HELCOM affiliated meetings 2003-2018 included, in addition to what could be considered as "HELCOM meetings", various smaller ad-hoc and internal meetings, events de facto organised by other organisations as well as meetings of externally funded projects with a variable degree of HELCOM involvement. Even if related to the implementation of the ecosystem approach, many of the meetings of these projects were not recorded according to the normal HELCOM standards, and perhaps also archived to an uneven degree during different time periods. This potential unevenness in the source material rendered the time series of these other meetings unreliable over the entire period.

Thus, to improve homogeneity of the dataset it was necessary to generate a subset of "regular HELCOM meetings" which would be as comparable over the entire study period if possible. To achieve this, only those meetings which fulfilled the following three criteria based on outward appearance of the meeting outcome/minutes were considered as "HELCOM Meetings" for the purposes of this study:

- meeting has a HELCOM style meeting/group abbreviation
- outcome written on the HELCOM document template or its close derivate (visual look)
- outcome written with numbered paragraphs

This resulted in groups of 724 'core HELCOM meetings', 209 other HELCOM meetings as well as 210 events organised by others. The reasoning behind this categorization was that the standard look of a HELCOM meeting outcome is an established standard practice, deviation from which usually indicates a deliberate choice to signal that the meeting was intended to be regarded as informal in the purest sense of the word. A deviation in the outlook of reports from the above criteria in many cases also indicated that the secretariat was not involved in the event. Even if some of these national

meetings could have been considered as HELCOM meetings in terms of substance, it was clear that many such national meetings and workshops were de facto serving also other commitments beyond HELCOM.

As the fourth step, every record of the refined list of HELCOM meetings 2003-2018 was enriched with meeting start and end times, participation grouped by delegation, information on the parent HELCOM working group of the meeting as well as other parameters. As meetings might have lasted for a few hours or a full working day the number of meeting days was not considered as sufficiently precise information. Information on exact start and (estimated) end times of meetings was retrieved manually from meeting invitations or in a category of documents called “annotations to the provisional agenda”. Even if these start-and-end times are issued before the start of the meeting in question, and thus do not necessarily reflect the actual realised timeframes, they were considered as sufficiently accurate estimates of actual start and end times based on fifteen years of personal experiences in organising HELCOM meetings. One underlying reason to this is the international nature of the meetings, due to which air travel schedules tend to fix the start and end times to those indicated in the invitation. For meetings running over several days the daily work hours were assumed as 9-17 if a programme was not available or if nothing else was explicitly specified, which was also considered as a reliable approximation based on practical experience. Lunches and breaks were counted to this calculated meeting time. Even if meetings do in some cases continue beyond normal office hours it was assumed that these can be considered as exceptions. The total active meeting hours of each meeting was calculated based on these premises. For a fraction of meetings, starting and ending times were not available and had to be estimated based on other meetings of the same or similar group.

Information on meeting participation was retrieved manually from the list of participants of each meeting report. These participant lists are included as a standard element of HELCOM meeting records and are based on actual participation (not only registrations) and carefully checked by the Secretariat. In the metadata, participation was recorded as number of

persons by delegation, covering, besides the nine Baltic Sea coastal countries and the EU, also the Secretariat, official observer organizations as well as invited guests. The Chairperson was recorded as belonging to the delegation of her/his member or observer organization. Unofficial HELCOM observers, consultants as well as other invited guests were recorded as belonging to the category “other participants” but even in these cases the actual country of origin and organization name of these participants were recorded as supplementary information in a dedicated column. Based on these records and assumptions the investment in person-hours, both for each attending delegation and in total, was calculated for each meeting. For a fraction of meetings, a list of participants was not available and had to be estimated primarily based on other meetings of the same or similar group.

Finally, each record on the list of meetings was designated to a substantial category (Table 1) which is partly based on the main or parent group of each meeting according to the organizational hierarchy of HELCOM but also other information. This was to generate a dataset on the actual substance/ content of the meetings and not the bureaucratic structure of HELCOM.

Even if the names of the main working groups have changed somewhat over the studied time period the content of the core groups has remained very similar, based on which a harmonised categorization of meetings could be generated, covering the whole studied period. The main changes consist of the creation of three new main working groups established as part of the work to implement the HELCOM Baltic Sea Action Plan (BSAP) and the Ecosystem Approach. These include HELCOM-VASAB MSP WG, FISH WG & AGRI WG, as well as one case where two main working groups, MONAS and HABITAT, were merged into a single group, STATE & CONSERVATION (S&C). However, as the S&C groups retained independent agenda points as well as separate timings for HABITAT-related substance (indicated in meeting invitations), it was possible to treat functionally as a separate group even after the merger. The S&C meetings also include agenda points of joint substance but as this was focused on indicators and assessments this share was designated to the “monitoring and assessment” category (cf. Table 1).

***Table 1**: The grouping of HELCOM meetings 2003-2018 used to generate substantial categories (MSP= Marine Spatial Planning, MPAs= Marine Protected Areas).*

SUBSTANTIAL CATEGORY	HELCOM GROUPS INCLUDED UNDER CATEGORY
Decision making	HOD, HELCOM, Ministerial Meetings
BSAP meetings	BSAP preparatory groups and meetings (2006-2007), BSAP Implementation group
State of environment assessments and monitoring	MONAS (2003-2014) and the share of S&C meetings not designated to nature conservation topics (2014-2018). In addition, all HELCOM groups and meetings focusing on monitoring, indicators and assesments were included: IN Eutrophication, EN HZ, TAPAS benthic indicator WS 1-2016, EUTRO-OPER, MORE, MONAS, CORESET/TARGREV JAB, CORESET, CORESET TOOLS, CORE EUTRO, HOLAS HAZAS, HOLAS BSPII, EUTRO-PRO, MON REV WS 1/2008, EN ESA, HOLAS II, HELCOM SPICE WSs 2017, BalticBOOST Theme 3 WS 2-2016, BalticBOOST HZ W, HELCOM BalticBOOST Biodiv WS 1-2016, EN HZ 1-2016 (HELCOM BalticBOOST HZ WS 1-2016), HELCOM TAPAS Pressure Index WS 1-2016, CORESET II 2015 BP, EUTRO-OPER, MORS, MORS EG, WS RAP ML 2018, HELCOM SPICE ML WS 1-2017, EN MARINE LITTER, HELCOM BalticBOOST Noise WS 1-2016 and EN NOISE
Pollution load assessments	Meetings related to pollution load assessment work (RedCore DG, PLC-7, PLC-7 IG, PLC-6, PLUS, PLC-5.5, LOAD, PLC-5)
Biodiversity and MPAs	HELCOM HABITAT (2003-2014) and since 2014- the share of S&C meetings designated to nature conservation topics as well as related meetings including MIGRATORY BIRD WS 1-2018, IN-BENTHIC, RED LIST meetings including workshops (e.g. RED LIST WS 1-2017, EU RED LIST HABITATS WS 1-2014), Seal work including HELCOM SEAL EG and workshops such as Ringed Seal EWS 1/2013 and HELCOM/ICES/EC Expert Workshop on seals in the Baltic Sea 2005, BALTFIMPA meetings, BIO (Biodiversity Assessment)
Spill response	HELCOM RESPONSE and its subgroups (SUBMERGED, SHORE Network, EWG OWR, IWGAS, TG HNS, EWG SHORELINE, MUNI. POR WS 2008)
Ship source pollution	HELCOM MARITIME and its subgroups and projects (HELCOM-OSPAR TG BALLAST, SAFE NAV, AIS EWG, GREEN TEAM, BALSAM WP4 on Ballast water, ALIENS 3, ALIENS 2, HELCOM/EMSA Project "Monitoring the banning of carriage of heavy grade oil in single hull tankers", TRANSIT ROUTE EWG, PILOT EWG)
Land and other pressures	Meetings of LAND (2003-2014) and PRESSURE (2014-) as well as their subgroups and projects not covered elsewhere (BALTHAZAR Project Steering Group Meetings, EWS DREDGE, EN DREDS, NCM/HELCOM project on "Screening of hazardous substances in the eastern Baltic Sea", HELCOM WG EIA 1/2004)
Ecosystem approach & MSFD coordination	GEAR and IG POM. Indicators, HOLAS and similar matters were included under the assessment category above.
Fisheries	Groups related to coastal fish monitoring (FISH-PRO II 2014-2018, HELCOM FISH 2008-2010, FISH PRO 2011-2013, Coastal Fish Monitoring Workshops 2004-2008), Fisheries and Environment Forum as well as HELCOM FISH and its subgroups (CG FISHDATA, CG AQUACULTURE, FISH-M).
Agriculture	HELCOM AGRI, Agri-Environment Forum
MSP	HELCOM-VASAB MSP WG

III. Compilation of documents adopted by HELCOM 2003-2018

A comprehensive list of documents which can be considered as adopted/endorsed by HELCOM during 2003-2018 was created to study changes in decisions as output of the HELCOM meeting machinery during the studied period. This list was created manually by using the search function of Adobe Acrobat on the pdf files of all the meetings reports ("Minutes of the Meeting") of the three HELCOM treaty bodies which have decision making powers: the annual meeting of the Helsinki Commission, Heads of Delegations (HODs) and HELCOM Ministerial Meetings from the studied period.

Expressions of adoption/endorsement of documents were identified from these reports by searching in the main part of the reports (excluding attachments/annexes) for terms "adopt(ed)", "agree(d)", "approve(d)" and "endorse(d)" as well as "decide(d)". In addition, the search word "mandate(d)" was used to include documents, where final powers of adoption/endorsement had been mandated to the expert level. The results of these queries; the names and references of all documents referred to by these terms were recorded to a spreadsheet.

The used search terms were selected as they were known based on the professional experience of the author to cover the key action words used within HELCOM to adopt/endorse documents. Several terms were used as the author knew that while "adopt" is likely the strongest, and "endorsed" the weakest, word traditionally used when adopting/endorsing documents, there was some degree of ambiguity in the meaning of these terms. This is especially true between the terms such as "agree" and "approve". This terminological ambiguity means that the final selection of term might include subjective decisions by a meeting secretary, chair, or a participant. Consequently, all the documents referred to by these action words were considered as candidates to be included in the list of adopted/endorsed documents. Even if other verbs such as "welcome(d)" and "note(d)" have also been used to refer to certain documents, they were considered as even weaker expressions than the selected terms.

The results of these queries, names of documents, were compiled in a spreadsheet enriched with additional details of the decision from the relevant paragraph of the meeting report, meeting name, year, and including additional information such as meeting outcome, paragraph number, key/action word used in a paragraph as well as a reference to the document if available (either as the Annex of the meeting outcome or as a meeting document reference). Some documents were only referred to as available on the HELCOM webpage, so no concrete reference was available.

Several document types identified by these searches did not fall under the aims of this study and were consequently ignored. Specifically, the following types of documents were not included in the document dataset even if they were referred to by search terms adopted/agreed/approved/endorsed or decided:

- Terms of References (TORs) and work plans of HELCOM groups
- Programmes and agendas of HELCOM events and meetings
- Outcome of the meeting in which the searches were made.
- Project proposals
- HELCOM Recommendations and other documents for later adoption elsewhere
- sections of documents which were later adopted in full
- vacancy announcements and related post descriptions
- budgets, audit reports and similar internal documents
- statements by individual contracting parties
- abstract references to approaches, status, ideas, aims and timetables as well as decisions to "use" documents without other references
- mandates to apply, and support letters for, external project applications, titles of documents, names of groups.

The identified documents were studied in more detail and categorised according to the following classes.

1. technical prescriptions, total bans of use (either as HELCOM or via requests to other bodies)
2. quantitative emission standards limit

3. procedural/practice recommendations. deletions of hotspots. (Also, ministerial declarations were included in this category as a kind of "borderline case")
4. environmental quality standards or assessments based on such standards
5. assessments and technical reports not explicitly based on quality or emission standards & descriptions of assessment tools
6. other policy documents (roadmaps, strategies, timetables and similar)
7. public dissemination publications and other information documents
8. establishing and implementing monitoring programmes, data calls.

As a final step the identified documents were categorised in the higher order categories "measures" or "assessments" as follows:

— documents in classes 1-3 were attributed with the category "measures"
— documents of classes 4-5 were attributed with the category "assessments".

The result was a list of 383 distinct adopted/endorsed HELCOM documents 2003-2018, as well as their reference information and final categorizations.

Please note that even if HELCOM has a formal policy instrument called "Recommendations" which could in theory have been the sole object of this kind of study. However, this approach was not considered to capture the whole picture of the HELCOM decision making as it was known from practical experience that, particularly during the studied period, the decisions to use the Recommendation format were taken on a non-uniform basis. Specifically, documents including important substantial decisions, such as e.g. target levels of indicators, were not adopted as HELCOM Recommendations.

Further, in order to find other key adopted HELCOM documents on the ecosystem approach, the spreadsheet containing all the documents adopted/endorsed by HELCOM 2003-2018 was searched with the term "ecosystem" in order to identify additional documents with titles referring to the ecosystem approach.

Results

I. References of ecosystem approach in the outcomes of HELCOM Ministerial Meetings

As summarised in Table 2, references to the ecosystem approach (or ecosystem-based approach) are found in the outcomes of all the five HELCOM ministerial-level meetings organised since 2003. In these documents the concept has been explicitly invoked in the connection of five main topics: the need to develop ecosystem quality objectives and indicators as well as related monitoring and assessment products, issues requiring cross-sectoral cooperation and measures (especially fisheries but also other fields), marine spatial planning, regional implementation of the EU Marine Strategy Framework Directive (MSFD), and more lately the importance of developing economic tools to demonstrate cost-effectiveness of measures (cf. Table 2). The following text will provide some supplementary notes on the appearances of the concept in the outcomes of each of the five meetings, including some references to supporting documents and developments between these events.

The ecosystem approach was launched to the HELCOM Baltic Sea cooperation in 2003 with two ministerial meetings organised in Bremen. The ecosystem approach is particularly highlighted as a central concept in the outcome of the joint HELCOM-OSPAR meeting in which the coastal countries of the Baltic and the North Seas committed to "by 2010 apply and further develop the measures necessary to implement an ecosystem approach" (JMM, 2003a). This was specified in the declaration (cf. §7 JMM, 2003a), as a decision following up earlier work within CBD, commitments made at the 2002 World Summit on Sustainable Development (WSSD, 2002) and especially supporting work toward the development of a European Marine Strategy (EC, 2002). The commitment to implement the ecosystem approach by 2010 was also specified by aiming to develop the necessary methodology and concepts by 2005 (JMM, 2003b).

The joint meeting also welcomed the following general definition of the Ecosystem Approach which had been adopted by both organizations at a civil

servant level as part of a dedicated statement document on the Ecosystem Approach (Annex 4 JMM, 2003c):

> "the comprehensive integrated management of human activities based on the best available scientific knowledge about the ecosystem and its dynamics, in order to identify and take action on influences which are critical to the health of marine ecosystems, thereby achieving sustainable use of ecosystem goods and services and maintenance of ecosystem integrity. The application of the precautionary principle is equally a central part of the ecosystem approach" (§5 JMM, 2003b)

This definition and the joint HELCOM-OSPAR statement on the ecosystem approach remain as the only explicit definition of the ecosystem approach adopted within HELCOM. Even if the concept itself is referred to in later documents (HELCOM, 2013a), both on expert and decision-making levels, these rely on this source when it comes to defining its content more precisely.

The Ecosystem Approach is also referred to twice in the outcome of the 2003 HELCOM ministerial meeting (HELCOM, 2003a), a meeting of the Baltic Sea countries and EU which was organized back to back to the joint meeting described above. The most specific reference to the ecosystem approach is in the context of revising the monitoring and assessment work, seen as necessary to speed up the publishing of monitoring results (HELCOM, 2003a, p. 6). The other reference is in a less concrete paragraph referring to the need for integrated management.

In line with the reference in the 2003 HELCOM declaration, the short-term practical implication of adopting the ecosystem approach concept was some months later defined to specifically mean the development of "ecological quality objectives" and related indicators within the organization (HELCOM, 2003b), essentially following the OSPAR approach (Heslenfeld and Enserink, 2008). In 2005 the HELCOM terminology and methodological steps were adjusted to a guidance document developed within the European Marine Strategy process (Rice et al., 2005). In addition to this pragmatic core of the implementation work, the integrative and cross-sectoral themes included in

the 2003 declarations paved way for future work in the field of Fisheries as well as “integrated ocean management” (later known as marine spatial planning, or MSP).

In the outcome of the 2007 ministerial meeting in Cracow, the Baltic Sea Action Plan (HELCOM, 2007a), the ecosystem approach concept appears explicitly only four times. Beyond two preambular references recalling of the 2003 meeting commitments the ecosystem approach is invoked explicitly twice, in the context of initiating a process to draft principles for Marine Spatial Planning in the Baltic Sea (HELCOM, 2007a, p. 20) and as a justification for a number of Fisheries-related measures (HELCOM, 2007a, p. 21).

Despite these surprisingly few explicit references, the Baltic Sea Action Plan was deeply rooted in the process to implement the ecosystem approach. The 2007 meeting and its outcome were explicitly designed to fulfil the 2003 commitment to develop a program of measures based on the ecosystem approach by 2010 (cf. preambula HELCOM, 2007a), was seen as a pilot of the EU marine strategy (HELCOM, 2007b) and its structure is given by the HELCOM ecological objectives developed and adopted as a follow up to the 2003 ministerial (Backer et al., 2010; Backer and Leppänen, 2008; HELCOM, 2006). The relatively massive document includes more than one hundred pages of commitments and measures in a wide range of issues and fields of human activity (e.g. pollution from agriculture, shipping and even crematoria), developed via a regional stakeholder process. As an important element (Backer et al., 2010; Bohman, 2018, p. 82) the document includes Baltic-wide and country-wise reduction targets for nutrient pollution, derived from the ecological objectives and preliminary indicators via ecosystem modelling by Stockholm University (Wulff, 2007).

In the outcome of the 2010 ministerial in Moscow the ecosystem approach is invoked explicitly three times beyond the preambular references to CDB and WSSD (omitting 2003 Bremen). These appearances are sections highlighting and specifying the role of HELCOM as the regional coordinating body of EU Marine Strategy Framework Directive (MSFD) implementation (HELCOM,

2010, p. 4) adopted in 2008 (EU, 2008), including the establishment of a dedicated group (HELCOM GEAR), in acknowledging the work of the HELCOM group on environmental effects of fisheries (est. 2008) as well as in a call to implement Marine Spatial Planning (HELCOM, 2010, p. 11). The 2010 ministerial in Moscow also considered a whole series of publications which had been developed in accordance with the indicator-based assessment system agreed in 2005 in the wake of the 2003 ministerial meeting (HELCOM, 2005).

In the 2013 Copenhagen declaration, the ecosystem approach is explicitly referred to when discussing the role of HELCOM as the regional coordinating body of EU MSFD (HELCOM, 2013b, pp. 3 & 5), the importance of monitoring and scientific data (p. 5), measures in the field of fisheries (p.11) and MSP (p. 19). In addition the ecosystem approach is referred to in the general context of increasing cross sectoral cooperation (maritime traffic, fisheries, agriculture, MSP and integrated coastal management) (HELCOM, 2013b, p. 5) which is linked to increasing "general awareness"(HELCOM, 2013b, pp. 3 & 5). In addition, a separate document on ecosystem approach as MSFD implementation was submitted to the meeting. This document highlights the opportunities of increasing the regional coordination of MSFD implementation, which had been perceived as weak during preparations for the 2012 EU MSFD reporting of initial assessments, and includes also an annex which includes a selection of HELCOM activities grouped according to the MSFD and ecosystem approach implementation process.

Finally, the 2018 Brussels declaration includes a group of five dedicated paragraphs (§§ 49-53) jointly titled "implementation of the ecosystem approach" (HELCOM, 2018). The section commits to carrying out regional economic and social assessments covering the issues of ecosystem services and natural capital (§50) as well as studies on cost of degradation and cost-benefit analyses on the attainment of good environmental status of the Baltic Sea (§51). Beyond this, the ecosystem approach is mentioned three times, in a paragraph committing to further development of indicators and scientific assessments (§15), in a reiteration of the commitment to develop MSP based

on the ecosystem approach (§55) as well as in a paragraph on the revision of the BSAP (§19), stressing that the renewed action plan should be based on the ecosystem approach.

Table 2: *A summary of the of the thematic context of explicit references to the "ecosystem approach" or "ecosystem-based approach" found in the outcomes of the five HELCOM ministerial-level meetings organised since 2003.*

Ministerial Meeting	**2003 Bremen** (HELCOM, 2003a; JMM, 2003a)	**2007 Cracow** (HELCOM, 2007a)	**2010 Moscow** (HELCOM, 2010)	**2013 Copenhagen** (HELCOM, 2013b)	**2018 Brussels** (HELCOM, 2018)
Thematic context of ecosystem approach references	Adoption of the ecosystem approach Developing monitoring and assessment, especially Ecological Quality Objectives & Indicators Commitment to develop program of measures based on EA by 2010. Support to EU marine strategy (Noting the role of EA in the reform of EU CFP)	Fisheries measures Maritime Spatial Planning (This document was designed to fulfil the 2003 commitment on a program of measures based on ecosystem approach by 2010. The structure of declaration and the reduction targets for nutrient pollution were based on the developed system of Ecological Objectives adopted 2006 & preliminary indicators)	HELCOMs role in regional coordination of EU MSFD implementation (esp. GES definitions & monitoring). Fisheries measures Maritime Spatial Planning	HELCOMs role in regional coordination of EU MSFD implementation. Fisheries (and other cross-sectoral) measures Maritime Spatial Planning (Increasing general awareness on the state of the Baltic Sea)	Developing economic and social assessments and the needed capacity and methods further development of indicators and scientific assessments Maritime Spatial Planning (revision of the 2007 Baltic Sea Action Plan)
n. of references to EA & EBM	14 (JMM), 3 (HELCOM)	5	5	13	5

II. Metadata on HELCOM meetings

The yearly number of core HELCOM meetings (in total 724 during 2003-2018), as defined under Material and Methods above (cf. part *II. Metadata on HELCOM meetings 2003-2018*), has more than doubled from 25 in 2003 to 66 in 2018 (Figure 2). A period of rapid increase in the number of core meetings took place between 2010 and 2012. The number of other HELCOM -organised meetings (in total 209, 2003-2018) was particularly high 2015-2017, and in general higher toward the end of the studied period (Figure 2).

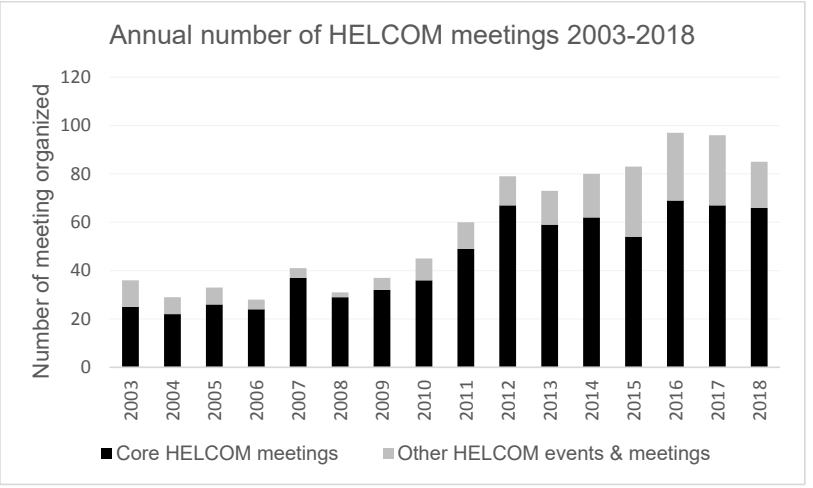

Figure 2: *Number of meetings organised by HELCOM per year 2003-2018. The orange values represent 'core HELCOM meetings' as defined above under methods (n=724). The gray values represent other HELCOM events including smaller task group meetings, seminars and external project meetings organised by HELCOM (n=209). The figure does not include other events (n=210) organised by other organisations or individual countries, which have been mentioned in the used HELCOM documents and archives.*

The estimated yearly number of person-hours spent in core HELCOM meetings has also doubled during the studied time period, from nearly 9 985 person hours in 2003 to around 18 365 person hours in 2018 (See Figure 3 A).

There is also an obvious peak in the number of meetings and meeting person hours in 2007 due to the intensive preparatory meeting related to the Cracow

Ministerial (BSAP) meeting (Figure 3 A). Similarly, there is a significant drop in meetings and meeting hours in 2015 due to a dramatic drop in the number of recorded meetings in the field of pollution load assessment (Figure 3 B), possibly related to the completion of work on assessment products on the achievement of the N & P load reduction targets agreed at the BSAP 2007 and revised in 2013.

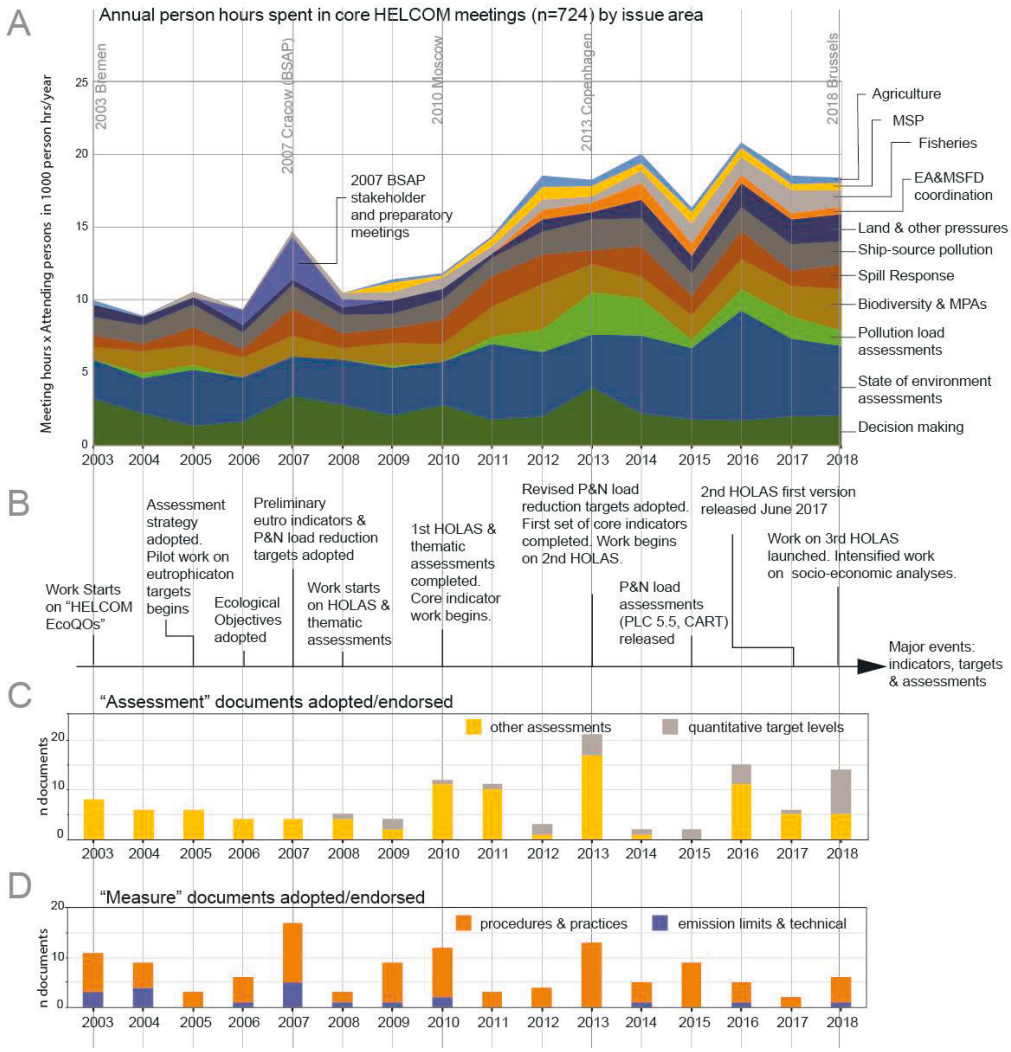

Figure 3: *Evolution of HELCOM work 2003-2018 in terms of person hours spent in HELCOM meetings (A), key events related to definitions of ecological quality/good status and related assessments (B), adoptions of assessment type documents/reports/publications (C) as well as adoptions of management measure type documents (D).*

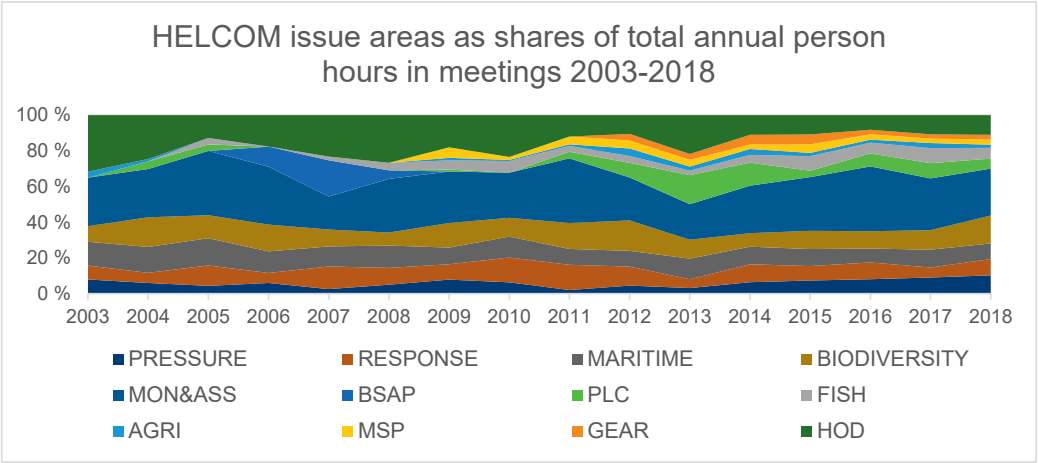

Figure 4: *Evolution of HELCOM work according to issue areas as shares of total annual person hours in meetings 2003-2018.*

These increases can be attributed to a uniform increase in meetings and their participation in traditional HELCOM work, but also to the emergence of entirely new fields of HELCOM activity (Figure 3A, Figure 4). A central new development has been the new HELCOM groups established on the topics of Fisheries, Marine Spatial Planning and Agriculture (FISH est 2008, MSP est 2010, AGRI est. 2010) as follow-up to the 2007 BSAP and its aims of policy integration. The combined share of total HELCOM work in these three fields increased from 2% (or 336 person hours) in 2007 to an 2014-18 average share of 12,0±1,8%), or 2240 ±194 person hours on an annual basis (V). A substantial, even if fluctuating, increase in the relative share of meeting hours since the BSAP (Figure 4) can also be observed in the topic of technical work on land-based pollution loads, which includes work to assess progress toward the maximum allowable input (MAI) and country allocated load reductions (CART), as well as revision of the initial 2007 MAI&CART for the 2013 Ministerial Meeting in Copenhagen. The HELCOM GEAR group (est 2012), with tasks on coordinating MSFD implementation in the Baltic Sea,

established in 2012, is also a new group which constituted an average of 3,6±1% of the total work 2012-2018 (Figure 3, Figure 4).

The other fields, experiencing an increase in person hours in meetings but a relatively stable share of the total HELCOM work, include monitoring and assessment of the state of the Baltic Sea environment, consistently the single field of HELCOM activity with the largest average number of person meeting hours. This field of activity constituted on average 28,4±4,0% of the total annual HELCOM work 2003-2018. The other more traditional fields include land-based pollution/pressures, maritime transportation, response to spills and biodiversity. These four issues together constituted on average 36,6±2,9% of overall HELCOM work 2003-2018 with equal shares. The number of person hours within the HELCOM decision making bodies, the Heads of Delegation (HOD) and the annual Helsinki Commission meeting has not increased during the period, and the relative share of these groups has consequently more than halved from 31,7% in 2003 to 11,0% in 2018.

Even if the described increase in HELCOM work 2003-2018 coincides with the implementation of the ecosystem approach also other processes took place in parallel. One is the EU regional work to implement the MSFD agreed in 2008, which includes the role of HELCOM as a regional coordination body which is difficult, if not impossible to separate from the ecosystem approach implementation as such. The other is the general increase in regional cooperation, possibly stimulated by the 2005 EU expansion in the region, as well as the EU Strategy for the Baltic Sea Region (EUSBSR), other related legislative initiatives such as the implementation of the EU MSPFD as well as the general surge of regional project funding (e.g. BONUS, INTERREG and even the GEF-funded Baltic Sea LME project 2003-2007). The clearer link to EU (MSFD) work has likely also made HELCOM more important, as an arena where interests need to be defended, with increasing participation as a result. The level and width of expertise needed to operationalize the science-based ecosystem assessment system has also likely increased the number of persons involved in HELCOM work.

III. Documents decided on by HELCOM 2003-2018

The number of HELCOM decisions concerning "assessment" content have seen particularly high peaks during 2013, 2016 and 2018 (Figure 3 C). Particularly many indicators with quantitative target levels, as well as assessment products using these were released during these years. As highlighted under methods, such "assessment" decisions include the adoption/ endorsement of environmental quality standards, assessments based on such standards, other assessments and technical reports.

The number of adopted or endorsed "measures" reached a high in 2007 (Figure 3 D), and during the Ministerial Meetings of 2003, 2010 and 2013 one can observe distinct peaks. These Measures depicted in Figure 3 D include technical prescriptions, total bans (either as HELCOM or via requests to other bodies) or quantitative emission standard limits. Another presented type of measures are recommendations on procedures/practices, ministerial declarations as well as the deletion of hotspots.

Discussion

As the use of the word "ecosystem" indicates, the ecosystem approach is a form of environmental management which aims to transform environmental management with the findings of ecosystem science (Grumbine, 1994). It also responds to calls for a perspective shift from considering ecosystem components in an isolated manner to a more holistic systems approach including also human societies, considered as more suitable in our Anthropocene era (Crutzen, 2006).

The definition of the ecosystem approach adopted with the concept in 2003 (JMM, 2003b) can be considered as only an aspirational framework. However, other sources such as the references within the HELCOM ministerial declarations of 2003, 2007, 2010, 2013 & 2018, highligted in Table 2, can be used as indirect evidence of organizational priorities in its implementation. In particular, these outcomes refer to the ecosystem

approach mainly in the connection of four themes: ecosystem quality target and related assessment work, cooperation and measures in the field of fisheries, marine spatial planning as well as regional implementation of the EU Marine Strategy (EC, 2002) and the subsequent Marine Strategy Framework Directive (EU, 2008) (c.f. Table 2 and the original documents).

From the meeting records it can also be observed that, coinciding with the implementation of the ecosystem approach within the organization, HELCOM cooperation has nearly doubled in volume between 2003 and 2018, both in terms of meeting participation and number of meetings. A large share of this increase is a result of increases within two specific categories of meetings which overlap with the issues highlighted in Table 2. One of these are meetings of the new cross-sectoral groups established for the purposes of ecosystem approach implementation, particularly that on fisheries and environment (est 2008), MSP (est 2010) and agriculture (est. 2010) but also the group on regional coordination of MSFD (est. 2012). Another area of particular increase are groups on pollution loads (Figure 3A, Figure 4).

Even if the described changes in HELCOM work 2003-2018 coincides with the implementation of the ecosystem approach, also other processes also took place in parallel. One is the EU regional work to implement the MSFD, agreed in 2008, which includes the role of HELCOM as a regional coordination body. The other is the general increase in regional cooperation, possibly stimulated by the 2005 EU expansion in the region, as well as the EU Strategy for the Baltic Sea Region (EUSBSR), other related legislative initiatives such as the implementation of the EU MSPFD as well as the general surge of regional project funding (e.g. BONUS, INTERREG and even the GEF-funded Baltic Sea LME project 2003-2007). In particular, it is not possible to separate between the implementation of the MSFD and that of the ecosystem approach within HELCOM based on the collected material alone.

The ecosystem approach as policy integration

The observed increase in, and references to, cooperation cross different sectors of human activity and the related agencies and institutions, particularly related to working groups in topics such as fisheries, MSP and agriculture (Figure 4), is a development which supports interpretations of the ecosystem approach as a strategy for more integrated environmental policy making. This also covers the role of concept in catalysing cooperation between competing interests, different fields of human activity and public policy as well as research traditions. Such integration is also a core meaning of the most influential definition of the ecosystem approach internationally, that of the Convention of Biological Diversity (CBD) cooperation (De Lucia, 2019; Platjouw, 2016). CBD refers to the concept as "…a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way" (§A5 of CBD, 2000).

Maritime Spatial Planning (MSP) (e.g. EU, 2014; Jay, 2010) which developed rapidly within the Baltic Sea region during the studied period (Backer, 2015, 2011) provides an example of this kind of integration. MSP is occupied with a forward looking and sustainable distribution of space to different human activities, as well as mediating between the involved environmental concerns and development interests (Hassler et al., 2013; Qiu and Jones, 2013). In a concrete sense the HELCOM cooperation on MSP involved a regular dialogue and information exchange in a dedicated intergovernmental working group on MSP in the Baltic Sea as well as negotiation on policy documents such as a set of joint principles (HELCOM and VASAB, 2010) and the specific regional guideline document on the ecosystem approach in MSP (HELCOM, 2016).

The central role of integration of Baltic Sea environmental concerns to different policy sectors of the European Union such as fisheries (regulated by the Common Fisheries Policy, EU CFP) and agriculture (Common Agricultural Policy, EU CAP) was recognised early (HELCOM, 2007a, 2003a) in the implementation of the approach (EC, 2002). In line with these concepts HELCOM also submitted joint inputs to the 2012 revision of CFP

(HELCOM, 2009) as well as to the 2008 CAP health check (HELCOM, 2008) as agreed at the 2007 ministerial meeting (HELCOM, 2007a).

Ecosystem approach as indicators and standards

One example of this kind of translation is the development of objectives, indicators, targets and related assessment on the "good status" (Mee et al., 2008) of, as well as pollution loads to, the Baltic Sea marine environment. This work has been another key element connected to the ecosystem approach in outcomes of high-level meetings (Table 2), and contributed to the increases in the volume of HELCOM work (Figure 3, Figure 4).

This dimension and work springs from an underlying regulatory approach in which targets for environmental or ecological quality, or 'immissions', are used as a basis for management. Using such an approach, a target level of ecological quality is set by the regulator, but the specific choices on measures to be taken to reach it are left to the responsible party. In fact the approach, as such is implying action only in cases where quality is at risk (Lübbe-Wolff, 2001). This introduces more flexibility, but also implementation challenges (Houck, 2003; Ringbom and Joas, 2018), compared to the traditional environmental regulation based on technical measures and emission limits (Boeve and Van den Broek, 2012). The approach represent a move in a more self-regulative direction (Nilsson, 2006) and is also consistent with the EU principle of subsidiarity (Boeve and Van den Broek, 2012).

These targets are an essential part of the "programmatic" (Boeve and Van den Broek, 2012) approach environmental policy in the EU (Boeve and Van den Broek, 2012; Ringbom and Joas, 2018). It was introduced to HELCOM work via the ecosystem approach but also as part of the closely interlinked work (JMM, 2003a) (Table 2) on the EU Marine Strategy (EC, 2002) and eventually the EU Marine Strategy Framework Directive (MSFD) (EU, 2008). While this "liberal" approach to environmental policy (Bernstein, 2000) in the EU context was initially promoted mainly by UK (Lübbe-Wolff, 2001), it can today be considered as part of a mainstream strategy, used in parallel to technical requirements and emission limits. Socio-economic assessments and related cost-benefit analyses, increasingly highlighted as

part of the HELCOM implementation of the Ecosystem Approach (Table 1) (HELCOM, 2018), can also be considered as related regulatory tools.

In many ways the regional work on defining and using targets of ecological quality is an experiment which is still ongoing. However, in retrospect, the crucial factor of time can be highlighted, both in terms of the long time needed to develop the targets themselves (Figure 3 B) as well as challenges to actually using them to follow-up implementation of measures due to systemic delays of the Baltic Sea. In the case of addressing nutrient pollution the results of modelling (Murray, 2019) show that, due to internal loading and other systemic delays, it will take a long time, even more than a century, before the full effects of input reductions taken today would lead to a good status of the Baltic Sea (Murray, 2019). Such time constraints could be a more integrated part of quality based environmental policies (O'Higgins, 2014; Varjopuro et al., 2014). Further, regulatory approaches using information on human activities or drivers of change could be more easy to link to concrete management measures (Rapport and Hildén, 2013).

However, regardless of their clear legal function or management utility, these definitions can be considered to have a pedagogical value. Their development has provided for a mutual learning process involving scientists and policymakers on how the Baltic Sea ecosystem works and what needs to be done (Bohman, 2018; Johnson, 2008), which was also one of the core original aims (I) (JMM, 2003b). As pointed out by the former OSPAR Executive Secretary David Johnson concerning the ecosystem approach in general: " Indeed, one of its primary purposes can be seen as facilitating the translation of 'ecosystem understanding' into high-level decision-making." (Johnson, 2008).

Ecosystem approach as measures?

Even if management measures emerging from the ecosystem approach are naturally of vital importance for the attainment of the overall goals, these are less commonly in the focus of studies on the ecosystem approach (Sander,

2018). In parallel to the increase in the investment in meeting time, the content of documents produced by the HELCOM cooperation seem to have shifted to emphasise scientific work in the form of assessments and indicators (Figure 3 C). In parallel, measures, especially measures involving concrete technical standards and emission limits, have decreased in relative importance (Figure 3 D). Even if one would consider that the decrease in agreed measures is a natural evolution for topics which have been on the agenda for a longer time, as implementation should take precedence over drafting measures, several new fields of cooperation have been introduced to the agenda for which few, if no concrete HELCOM measures exist.

In 2006 the German Advisory Council for the Environment warned (SRU, 2006) that the approach and work plan adopted by European Marine Strategy, and later by MSFD, would delay implementation of the needed measures (SRU, 2006). Figure 3, indicating a shift from technical measures to cross-sectoral dialogue and scientific products such as indicators and assessments could indicate such challenges. However, such a change at HELCOM does not mean that decisions on concrete measures would not have been taken at all. They are likely simply taken elsewhere: within EU and individual coastal states, including also Russia. The surprisingly persistent tradition on shipping measures within HELCOM will perhaps continue to remain as an exception fueled with the synergy with the work done by coastal countries and EU at the International Maritime Organization (IMO) (Backer, 2018; Ringbom, 2018).

For HELCOM this refocusing and close alignment with EU MSFD implementation process has been natural as has been explicitly called for by Article 6 of the MSFD (EU, 2008). In some ways it can even be considered as an act, or event, of survival by which HELCOM avoided regulatory marginalization and eventually the fate of the International Baltic Sea Fishery Commission (IBSFC), a regional fishery organization closed down in 2007 following EU enlargement.

Finally, the expanded activities in thematic fields such as MSP, fisheries, and agriculture (Figure 3A) will likely require long processes of 'acclimatization' during which the new mix of professional communities and regulatory agencies find ways to work together. Agreements related to contentious management measures within HELCOM or elsewhere are not likely in the short term. In retrospect exceptions such as the HELCOM inputs on CFP (HELCOM, 2009) and CAP (HELCOM, 2008) revisions, perhaps somewhat roundish in substance, were a significant achievement.

Conclusions

During 2003-2018 HELCOM has implemented a version of the ecosystem approach adopted by HELCOM in connection to regional dimensions of the EU Marine Strategy (2002) process and has evolved during subsequent regional implementation of the EU Marine Strategy Framework Directive (2008). Due to the central role of science-derived targets of ecosystem quality this HELCOM interpretation of the ecosystem approach has a different focus compared to the ecosystem approach as agreed in the context of the Convention on Biological Diversity (CDB).

It is not possible to separate between the implementation of the MSFD and that of the ecosystem approach within HELCOM based on the collected material alone. With this caveat the findings of this study largely confirm earlier findings on HELCOM ecosystem approach implementation, especially on the strong European dimension in the ecosystem approach implementation in the Baltic Sea (Bohman, 2018; Hassler et al., 2013; Hegland et al., 2015; Ringbom and Joas, 2018; Söderström, 2017) as well as the central role of environmental quality standards and assessments (Bohman, 2018, 2017). The findings also confirm the qualitative observation by Valman that there has taken place thematic expansion of HELCOM work without subsequent cuts in old issues, observed by Valman as 'layering' (Valman, 2014, p. 43).

The results challenge the notions that the implementation of the ecosystem approach has not resulted to any deeper institutional changes within HELCOM (Hassler et al., 2013; Hegland et al., 2015; Söderström, 2017; Valman, 2014). A potential manifestation of the latter is the relative increases in the cross-sectoral fields of MSP, fisheries and agriculture and regional coordination of the MSFD (Figure 3, Figure 4). The other is the relative decrease in the adoptions of technical measures (Figure 3).

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An error, made during the final stages of the writing process and noticed by the candidate only after printing, had unfortunately replicated in Article V and the summary section (in total 8 instances for the whole thesis). These instances have been corrected in the digital version after 22nd December 2020 as specified below.

Summary Chapter (pp: 1-83):

1. (Abstract EN) p.7

Original printed file (section in square brackets):

"Comparing the types of documents adopted by HELCOM in the beginning and end of the period 2003-2018 there is some evidence that a shift has taken place from technical specifications and concrete emission standards to more [voluntary lists of recommended measures, roadmaps,] assessment products & indicators."

Corrected text:

"Comparing the types of documents adopted by HELCOM in the beginning and end of the period 2003-2018 there is some evidence that a shift has taken place from technical specifications and concrete emission standards to more assessment products & indicators."

2. (Abstract FI) p. 9

Original printed file (section in square brackets):

"Ajanjaksolla hyväksyttyjen asiakirjojen lukumääriä ja tyyppejä tarkasteltaessa teknisten määräysten ja päästöstandardien suhteellinen merkitys on laskenut ja [vapaaehtoisten toimenpidelistojen, tiekarttojen,] arviointiraporttien ja indikaattorien vastaavasti kasvanut."

Corrected text:

"Ajanjaksolla hyväksyttyjen asiakirjojen lukumääriä ja tyyppejä tarkasteltaessa teknisten määräysten ja päästöstandardien suhteellinen merkitys on laskenut ja arviointiraporttien sekä indikaattorien vastaavasti kasvanut."

3. (Abstract SE) p.11

Original printed file (section in square brackets):

"Jämförelse av de dokumenttyper som antagits av HELCOM i början och slutet av perioden 2003–2018 visar på att en övergång har ägt rum från tekniska specifikationer och konkreta utsläppsstandarder till mer [frivilliga listor över rekommenderade åtgärder, färdplaner,] bedömningar och indikatorer."

Corrected text:

"Jämförelse av de dokumenttyper som antagits av HELCOM i början och slutet av perioden 2003–2018 visar på att en övergång har ägt rum från tekniska specifikationer och konkreta utsläppsstandarder till mer bedömningar och indikatorer."

4. (M&M) p.45

Original printed file (section in square brackets):

"2003-2018, which were categorised to two main types 'measures' and 'assessments'[, the latter also including soft policy documents such as roadmaps and similar]."

Corrected text:

"2003-2018, which were categorised to two main types: 'measures' and 'assessments'."

5. (Conclusions) p.69

Original printed file (section in square brackets):

"Comparing the types of documents adopted by HELCOM in the beginning and end of the period 2003-2018 it can be observed that a shift has taken place from technical specifications and concrete emission standards to more [voluntary lists of recommended measures, roadmaps,] assessment products & ecological quality standards."

Corrected text:

"Comparing the types of documents adopted by HELCOM in the beginning and end of the period 2003-2018 it can be observed that a shift has taken place from technical specifications and concrete emission standards to more assessment products & ecological quality standards."

Article V (pp. 139-176)

6. (Abstract) p. 139 (p.1)

Original printed file (section in square brackets):

"Simultaneously, the point of gravity of organizational output has shifted away from traditional technical measures and more toward assessments [, indicators, and soft policy tools]."

Corrected text:

"Simultaneously, the point of gravity of organizational output has shifted away from traditional technical measures and more toward assessments and indicators."

7. (Results) p.164 (p.26)

Original printed file (section in square brackets):

"As highlighted under methods, such "assessment" decisions include the adoption/ endorsement of environmental quality standards, assessments based on such standards, other assessments, and technical reports [as well as soft policy tools such as roadmaps and strategies]."

Corrected text:

"As highlighted under methods, such "assessment" decisions include the adoption/ endorsement of environmental quality standards, assessments based on such standards, other assessments, and technical reports."

8. (Discussion) p. 169 (p.31)

Original printed file (section in square brackets):

"In parallel to the increase in the investment in meeting time, the content of documents produced by the HELCOM cooperation seem to have shifted to emphasise scientific work in the form of assessments [, indicators and soft policy measures] (Figure 3 C)." (…) "Figure 3, indicating a shift from technical measures to cross-sectoral dialogue and scientific products such as indicators and assessments []."

Corrected text:

"In parallel to the increase in the investment in meeting time, the content of documents produced by the HELCOM cooperation seem to have shifted to emphasise scientific work in the form of assessments and indicators (Figure 3 C)." (…) "Figure 3, indicating a shift from technical measures to cross-sectoral dialogue and scientific products such as indicators and assessments could indicate such challenges."

In addition, some missing punctuation have been corrected in the pdf version for a more finished file.